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SCHEMAS FOR READING AND RECALL OF STORY NARRATIVE AND DESCRIPTIVE INFORMATIONAL TEXTS: A STUDY OF SIXTH GRADE PROFICIENT READERS

by

© ELAINE ROSEMARY FURNISS

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Schemas for Reading and Recall of Story Narrative and Descriptive Informational Texts: A Study of Sixth Grade Proficient Readers" submitted by Elaine Rosemary Furniss in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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Date October 31/78

DEDICATED TO MY MOTHER AND FATHER

ABSTRACT

The study was concerned with the variable of text structure which is known to affect comprehension and recall processes within elementary school children.

The study was conducted in two stages. Firstly, a survey was made of science content area texts available to upper elementary school children. The use of a STORY NARRATIVE text structure by some authors, and its omission by others, was noted. Experimental texts were devised according to a story grammar (Thorndyke, 1975) and a DESCRIPTIVE INFORMATIONAL prose structure developed by the researcher. The second stage consisted of the administration of experimental texts to 32 subjects, who were required to read and recall immediately and after one week, two texts differing in content and text structure. An interview study followed the delayed recall task.

The population from which subjects were selected for pilot study and experimental tasks consisted of 140 grade six students in 12 suburban schools in Edmonton, Alberta. This population was selected by the research division of the Edmonton Public School System as representative of a cross-section of the 118 elementary schools in the system. All students were defined as proficient readers by their scores on the 77th percentile or above on the Reading Subtests of the Stanford Achievement Test (Kelly et al., 1964).

Recall protocols collected during the second stage of the study were analyzed into hierarchical lists of propositions (Kintsch, 1974), and further categorized in recall categories (Drum & Lantaff, Note 7). By comparing the subject's recall protocol with the template text, assessments were made of: (1) proportions of propositions recalled, (2) proportions of propositions recalled in specific categories of recall, (3) proportions of types of propositions recalled, (4) proportions of propositions recalled from specific hierarchical levels in the template text, and (5) proportions of propositions recalled from specific template text sections. Original groups were collapsed to allow comparisons within the same content topic, but between text structures.

Sixth grade proficient readers were found to recall proportionately more propositions from STORY NARRATIVE texts than from DESCRIPTIVE INFORMATIONAL texts, both immediately and after one week.

Text structure did not affect the proportions of propositions recalled in specific recall categories.

Predicate and connective propositions were more frequently recalled in STORY NARRATIVE texts than in DESCRIPTIVE INFORMATIONAL texts. Conflicting proportions of modifier propositions recalled in differing structures, between content topics, were explained by the relative familiarity of the TELEPHONE content topic.

Most propositions recalled from STORY NARRATIVE texts were high level propositions in the template text, whereas most propositions recalled from DESCRIPTIVE INFORMATIONAL texts were propositions at lower levels in the template text, in both immediate and delayed recall conditions.

Text structure affected the proportions of propositions recalled from specific template text sections, in both immediate and delayed recall conditions. This was more evident in the NERVE CELLS texts than in the TELEPHONE texts probably due to the poor differentiation between text sections in the TELEPHONE DESCRIPTIVE INFORMATIONAL text.

The interview study indicated that sixth grade proficient readers use a variety of strategies for memorizing and later recall of text.

Implications from the study were provided for reading theory, reading teaching, the development of reading tests, the development of questions about text, and the writing of children's texts.

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CHAPTER 1

INTRODUCTION

> Anyone who prepares to tackle the complexities of discourse is in for enough work that it behooves him to think carefully, before he begins, about what he is looking for and why. (Grimes, J. E. The thread of discourse, 1968, p. 28)

The processes of comprehension and recall of discourse are dependent upon many variables, a number of which have been studied by reading researchers in attempts to survey their effects. A very sweeping generalization would suggest that many text studies during the 1960's were syntactically oriented, while those of the 1970's have been more involved with the semantics of text and the structures by which ideas in text are conveyed. It is with the variable of text structure that this study will be concerned.

Reading researchers and educators have commented briefly on the effects of differing text structures on the comprehension and recall of information from prose (Harris & Smith, 1972; Karlin, 1975). However, it has only been in the past decade, that specific systems have been devised, which enable researchers to comment expressly on the nature of comprehension and recall differences resulting from varying text structure (Crothers, 1972; Frederiksen, 1972; Kintsch, 1974; Meyer, 1975; Rumelhart, 1975; Stein & Glenn, 1977).

In attempting to identify dimensions of similarity and difference among different types of prose, and, in evaluating what is remembered after reading prose, many investigators have limited their studies to simple folk stories because of the common, underlying structural elements which are present (Gentner, 1976; Mandler & Johnson, 1977; Thorndyke, 1977, Kintsch, Note 1; Stein & Glenn, Note 2). Other studies have investigated recall of factual, descriptive material (Bower, 1974; Meyer, 1975; Schank, 1975; Berger & Perfetti, 1977).

Many studies have involved subjects in the free recall of information which has been visually or auditorially presented (Bartlett, 1932; Dooling & Lachman, 1971; Bransford & Johnson, 1972; Frederiksen, 1973; Kintsch & Keenan, 1973; Bower, 1974; Meyer, 1975, Kintsch et al., 1975; Gentner, 1976; Brown & Smiley, 1977; Mandler & Johnson, 1977; Smiley et al., 1977; Thorndyke, 1977; Zimiles & Kuhns, Note 3). Recent studies have inferred comprehension and recall processes from a combination of tasks: free recall, specific question-answering (McLeod, 1978; Omanson, Warren & Trabasso, Note 4), differentiating between explicit, implied and intrusive statements (Sachs, 1967; Bransford & Franks, 1971; Kintsch & Bates, 1977; Hildyard, Note 5; Meyer, Brandt & Bluth, Note 6), summarization (Kintsch & Kozminsky, 1977), and the ordering of pictures related to text (Brown, 1975; Kintsch, Note 1).

Most studies have used adult comprehenders as subjects and the auditory mode of presentation. Few studies have investigated children's comprehension of prose using a visual mode of presentation (Berger & Perfetti,1977; Mandler & Johnson, 1977; Kintsch, Note 1).

Brown (1975) has suggested that asking children what they know about what they remember, and how they remember after reading, might also be a useful source of information for inferring comprehension and recall processes (pp. 110-113). The paucity of research of this type has been noted (Brown, 1975), but as Jenkinson (1976) states, "we are only at the threshold of exploring how reading and memory are related" (p. 70).

I. PURPOSE

The purpose of this study will be to investigate the effects of varying text structures on specific text-related variables. As well as the initial question of how much is remembered when text structures are different, this study will compare the effects of varying text structure on variables which have been discussed at length by several researchers who have developed procedures for analyzing discourse. This will be attempted to see if the distinctions made about the comprehension and recall behaviors of readers when reading one type of prose (i.e., simple stories), can also be made when two types of prose (i.e., STORY NARRATIVE prose and DESCRIPTIVE INFORMATIONAL prose) are utilized. These variables are discussed in Chapters 2 and 5.

In addition the study will probe children's knowledge of text structure differences and memory for prose through a series of interview questions.

Jenkinson (1976) lists four types of essential knowledge which need to be integrated for successful information processing.

> These are: a knowledge of verbal concepts;
>
> a knowledge of grammar which subsumes syntactic and semantic competence at both the sentence and the discourse levels;
>
> a knowledge of the situations or "contexts" that are captured in written materials;
>
> a knowledge of the "rules and strategies" of the language game that is implicit in the writer's message. (p. 74)

This study is primarily concerned with the second type of knowledge as it is evidenced by the reading behaviour of sixth grade proficient readers. Strategies for remembering and recalling texts will also be studied.

II. DEFINITIONS

For the purposes of this study, the following definitions were used.

1. Discourse

Discourse refers to a sequence of connected sentences constituted of either a complete story (STORY NARRATIVE discourse), or a coherent explanation of a particular topic (DESCRIPTIVE INFORMATIONAL discourse). Discourse is synonymous with the terms text and prose in this study.

> It is assumed that a (coherent) text can be characterized as a set (or as sets) of sentences (utterances) between which certain global relations hold on the basis of which this set (or these sets) is (are) perceived as a coherent whole . . . These relations are thought to be syntactic, semantic and pragmatic in nature. (Verdaasdonk, 1977, p. 94)

2. STORY NARRATIVE Prose

STORY NARRATIVE prose refers to a sequence of connected sentences which tell a story. A simple plot for a story may involve a problem facing a main character, a sequence of attempts by the main character to solve the problem, and an eventual resolution of the problem (Bower 1974; Rumelhart, 1975; Kintsch, Note 1).

3. DESCRIPTIVE INFORMATIONAL Prose

DESCRIPTIVE INFORMATIONAL prose consists of a sequence of connected sentences which is an explanation or a description of a particular topic. Informational prose is often characterized by terseness, density of detail and specific generalization, or series of generalizations about the topic in question (Karlin, 1975).

4. Comprehension

Comprehension is a complex of interrelated processes which comprise the understanding which comes from reading sequences of connected sentences (Frederiksen, 1972). This understanding is adequate "to the extent that the language receiver apprehends, at least provisionally, whatever linguistic information is present in the message and is able to relate that information to whatever context is available at a given time" (Carroll, 1972, p. 24). In this study, particular attention will be paid to children's concepts and manipulation of text structure, "a 'cognitive structure' that consists of a large number of 'comprehensions' or 'understandings'" (Carroll, 1972, p. 1). This structure enables children to comprehend prose (Rumelhart, 1975; Guthrie, 1977; Kintsch, Note 1).

5. Recall

Recall, in this study, involves

> . . . an attempt to reconstruct information corresponding to information produced at the time of initial presentation. Recall is comprised of two stages:
>
> (1) implicit generation or production of possible responses; and
>
> (2) recognition of one of the generated alternatives as meeting criteria of acceptability. (Eysenck, 1977, p. 72)

Transcripts of subjects' recalls will be used by the experimenter to infer what each subject has understood and remembered. Recall will be immediate (directly following the written presentation) and delayed (one week following the written presentation), for certain experimental tasks.

6. Recall Analyses

Two methods of analyzing recall protocols will be utilized in this study:

(i) Text recall analysis includes those response proportions in a subject's recall protocol which repeat template text propositions or use synonymous propositions,

(ii) Text plus text entailed recall analysis includes text recall responses plus responses which summarize information from two or more text propositions or make explicit (i.e., text connecting) inferences derived from the template text.

7. Recall Categories

Recall categories are text recall, text entailed recall, text evoked recall and text external recall. These categories were derived from the categories of recall developed by Drum and Lantaff (Note 7). Their specific purpose is to allow for the systematic analysis of all of the recall utterances of a comprehender.

8. Propositions

Propositions consist of lexical items. Each proposition contains a relation and 'n' arguments ($n > 1$) which, together express a particular idea. The number of propositions in a text has been suggested as a quantitative measure of the content difficulty of text. The particular types of propositions (predicate, modifier, connective) and the structural relations among propositions (superordinate and subordinate propositions) may also affect text difficulty (Kintsch & Keenan, 1973). Propositions are enclosed by parentheses; the relation is always written first and all terms are separated by commas. Some examples of propositions are given in Appendix A. The terms proposition, and propositional unit are synonymous in the study.

9. Template Text

The template text is an hierarchical listing of all the propositions derived from a text. This listing expresses completely the ideas that an author has in mind in a text. The terms template text, experimental text and text base are synonymous in the study.

III. RESEARCH QUESTIONS AND HYPOTHESES

In order to achieve the purposes set for this investigation, the following research questions and null hypotheses were formulated.

Research Question 1

Do proficient sixth grade readers organize information from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose in different ways for recall tasks after reading?

Hypothesis 1.1

There will be no significant main effects or interactions between proportions of propositions recalled immediately and after one week by groups of sixth grade proficient readers when reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Hypothesis 1.2

There will be no significant main effects or interactions between proportions of propositions in the recall categories of information (i.e., text recall, text entailed recall, text evoked recall and text external recall) recalled immediately and after one week by sixth grade proficient readers after reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Hypothesis 1.3

There will be no significant main effects or interactions between proportions of types of propositions (i.e., predicate, modifier, connective) recalled immediately and after one week by sixth grade proficient readers after reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Hypothesis 1.4

There will be no significant main effects or interactions between proportions of propositions recalled at particular levels in the text hierarchy immediately and after one week by groups of sixth grade proficient readers from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Hypothesis 1.5

There will be no significant main effects or interactions between proportions of propositions recalled in text sections (i.e., Setting and Theme/Plot/ Resolution for STORY NARRATIVE texts and Topic Identification/Topic Expansion / Conclusion Statements for DESCRIPTIVE INFORMATIONAL texts) both immediately and after one week, by groups of sixth grade proficient readers from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Research Question 2

Do sixth grade proficient readers view the STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts as differing according to structure?

Research Question 3

What strategies do proficient sixth grade readers knowingly use to remember STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose for recall tasks after reading?

IV. ORGANIZATION OF THE STUDY

This study was conducted in two stages. The first involved a survey of texts and reference materials, within the content area of science, which are used by children in upper elementary grades. Further to this survey, experimental texts were devised according to criteria for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose passages. Several pilot studies and different types of text analysis were conducted to test the suitability of experimental texts.

The second stage involved the collection and analysis of data to answer the specific research questions of the study. Subjects were required to read and recall immediately and after one week two texts differing in content and text structure. In addition, interview questions were asked of each subject following the delayed recall tasks. This was done to assess strategies for remembering prose and to answer Research Questions 2 and 3.

Each subject's recall protocols were analyzed into hierarchical lists of propositions and categorized according to a recall category system. Assessments were made of proportions of propositions recalled, proportions of propositions recalled in specific categories of recall, proportions of types of propositions recalled, template text position of recall propositions, and hierarchical levels of information in recall. All assessments were made by comparing the subject's recall protocol with the template text which had been read previously.

Three way analyses of variance and Newman Keuls post hoc comparisons of means were conducted to test hypotheses which were developed in this chapter.

Interview responses were categorized on initial inspection and specific relationships were inferred between the interview response information and the significant statistical information resulting from data analysis.

V. LIMITATIONS OF THE STUDY

The limitations of the study are as follows:

1. The study will compare two types of text (STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL). The differences between STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text will be confined in this study to the differences which are evident in the passages written for the study, based upon the analysis of materials read by pupils in grade six.

2. It will not be possible to make generalized statements about global organizational differences in written language and children's recall of written language. The study is limited to comparisons between two types of text (STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL). In some instances, both types of text are found in the one passage, e.g., historical, narrative prose. For this reason, DESCRIPTIVE INFORMATIONAL prose passages are confined to passages which are descriptive, have a specific generalization and many supporting details.

3. The grade six subjects will be selected for this study on the basis of their reading proficiency to ensure that ability in reading will not affect the efficiency of recall of text. For this reason, findings cannot be generalized to all sixth grade readers.

4. Experimental tasks cannot provide direct access to the actual organizational processes of proficient sixth grade readers. However, it is hoped that recall protocols will adequately evidence the organizational activities of proficient sixth graders when reading and remembering DESCRIPTIVE INFORMATIONAL and STORY NARRATIVE prose.

5. Techniques of analyzing recall from prose are comparatively recent. Findings from this study are dependent on the validity of the constructs on which the analysis is based.

VI. SIGNIFICANCE OF THE STUDY

One significant reason for this study is the contribution its results will hopefully make to the further understanding of how children comprehend and remember information from prose.

Previous studies of this type have examined children's comprehension and recall of stories. No comparisons have been made of the differences in organization and recall of STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose. The present study represents a first attempt at examining these differences.

Three specific practical implications for this type of research are evident:

Firstly, definitions of DESCRIPTIVE INFORMATIONAL text structure and STORY NARRATIVE structure will be helpful in guiding children's memory for textual materials.

Secondly, definitions of generalized STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text schemas could be used to investigate practical problems in reading. Meyer (1975) noted that it would be of interest to classify the parts of text schemas which consistently do not recur in the recall protocols of poor readers.

Thirdly, analyses of how meaningful ideas are organized for recall could have implications for the writing of children's books. Associating the organization of textual materials with a generalized text schema (particularly for DESCRIPTIVE INFORMATIONAL prose) should lead to the discovery of ways in which prose may be more efficiently recalled by children.

VII. PLAN OF THE REPORT

Chapter 2 surveys related literature and research.

Chapter 3 explains the experimental design of the study

Chapter 4 gives a detailed description of the development and testing of experimental texts and tasks.

Chapter 5 summarizes and discusses the results.

The concluding chapter, Chapter 6, contains concluding remarks and implications for teaching, research and theory.

CHAPTER 2

BACKGROUND OF RESEARCH IN DISCOURSE COMPREHENSION AND MEMORY

The purpose of this chapter is to provide a background for the study of children's comprehension and recall of discourse. The chapter will define comprehension as it relates to the processes of reading and recall in this study, and examine those variables which have been found to affect the comprehension of discourse. Such variables help to define the process of comprehension as opposed to the end product of understanding what is read, as measured by various recall tasks. These variables are measured by controlling other known process variables, allowing one to vary,and measuring recall differences. Variables include the use of prior knowledge, the ability to infer, the constraints of context and task demands, and the structure of the text. In an interrelated manner, these variables help to determine the reader's level of understanding. Problems associated with the evaluation of what is retained after reading text will also be discussed.

I. THE COMPREHENSION AND RECALL PROCESSES

Recent models of comprehension focus on a holistic complex of interrelated processes rather than partitive end products such as specific vocabulary knowledge (Lindsay & Norman, 1972; Frederiksen, 1972; Kintsch, 1977). These processes are active. The reader does not passively "soak up" information presented in the text, but relates it to prior knowledge and the context of the reading experience, in terms of his experiences with life and language. The structure of the text also has been found to affect what has been comprehended and can be recalled from text. Research on the comprehension process has often involved the manipulation of one or more of the variables outlined above, to assess their effects on recall. Different systems for analyzing what has been comprehended have been developed, based on recognition tasks (Kintsch & Bates, 1977; Hildyard, Note 5), or the scoring of recall responses in terms of concepts remembered (Kintsch et al., 1975; Stein & Glenn, 1977; Meyer, Brandt & Bluth, Note 6; Drum & Lantaff, Note 7).

Understanding is measured, using such systems, by the degree to which the meaning of the author as interpreted by the researcher, is present in the reader's recall of the author's meaning, also as interpreted by the researcher. Simple analyses of readers' prior knowledge (estimates of potential for reading specific contents), varying text structures, inferencing strategies and task demands for reading, have been developed to infer processes operating during comprehension and recall. When such an assessment is made, comprehension and memory appear to be inseparably linked, with the possibility that memory is an "automatic or involuntary product" of comprehension (Brown, 1975, p. 107).

Comprehension is not an "all or nothing" phenomenon. It can occur to different degrees depending, among others, on the processing variables of prior knowledge, inferencing ability, task demands and text structure. These processing variables are similar in description to the control processes described in Atkinson and Shiffrin's general framework for human memory (1968):

> Control processes are not permanent features of memory, but are, instead, transient phenomena under the control of the subject; their appearance depends on such factors as instructional set, the experimental task, and the past history of the subject. (p. 106)

The introduction of the notion of control processes in memory led to ideas such as the levels of processing concept (Craik & Lockhart, 1972). They were able, by controlling the means of coding, to show that retrievability or recall of information was closely related to the type of coding utilized. Later research related levels of processing to reading, by showing that more meaningful sets to remember, such as memory instructions, rewording of given sentences, providing new sentences after given text sentences, and reading for specific purposes, resulted in comprehension and recall to a greater depth (Mistler-Lachman, 1974; Schallert, 1976; Frase, 1977; Zimmer, Note 8).

Kintsch (1977) has described the processing which occurs during reading as "highly interactive components occurring in parallel" (p. 328). See Figure 2.1.

One can view these as control processes by which the level of comprehension, as measured by some type of recall or recognition task, will vary for a group of individual readers.

Elsewhere, the coordination of these processes has been termed metamemorial strategies (Flavell & Wellman, 1977), knowing how to know (Brown, 1975), or the ability of the processor to transform

An Outline of Stages of Comprehension in Reading, the Memory Traces Arising from these Processes, and Their Selection for Encoding in Memory. The Thickness of the Arrows Indicates the Likelihood that Particular Types of Memory Traces Will be Encoded in Memory for Long Term Retention under Standard Reading Conditions. (after Kintsch, 1975)

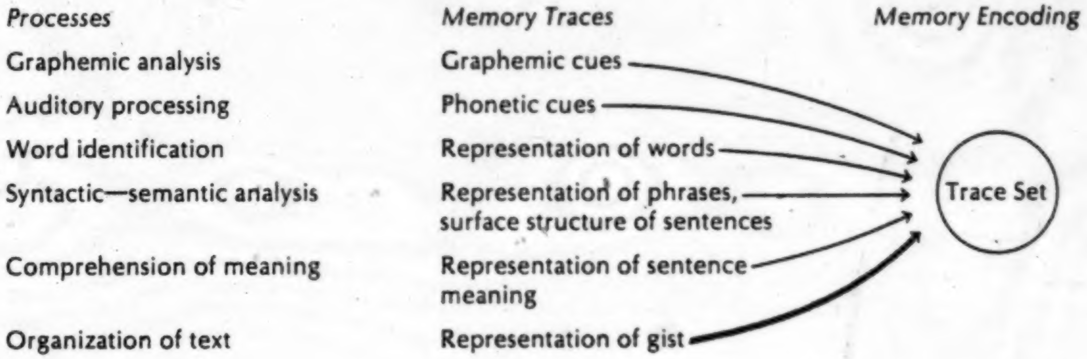

Processes
Memory Traces
Memory Encoding
Graphemic analysis
Graphemic cues
Auditory processing
Phonetic cues
Word identification
Representation of words
Syntactic—semantic analysis
Representation of phrases, surface structure of sentences
Trace Set
Comprehension of meaning
Representation of sentence meaning
Organization of text
Representation of gist

Figure 2.1

Processes Involved in Reading a Story
(From Kintsch, 1977, p. 329)

episodic events into semantic memory (Tulving, 1972). Another group of researchers have termed the organizational frameworks, schemas (Bartlett, 1932; Kintsch, 1974; Neisser, 1976). These terms are related in function, if separated by definition. Whatever the term, the complex of processes accounts for much of the variation in comprehension levels of individuals as measured by recall or recognition analyses.

Summary

Recent researchers and theorists in comprehension and memory suggest that the reader utilizes a highly interactive group of complex processes to read and remember discourse. To a large degree the extent to which the processes are used is dependent upon the ability within the reader to implement acquisition and retrieval processes according to his purpose. This study is specifically concerned with the effect of structure variation on the comprehension and recall of discourse. However, a survey of research into other variables such as the use of prior knowledge, the ability to infer, and the demands of the task and the context, will be outlined, to give perspective to the study.

II. VARIABLES WHICH HELP TO DEFINE THE PROCESSES OF COMPREHENSION AND RECALL

Prior Knowledge

Prior knowledge plays a distinct role in the comprehension and recall of discourse (Dooling & Lachman, 1971; Bransford & Johnson, 1972; Carroll, 1972; Haviland & Clark, 1974). Specific events and systems for guiding the interpretation of present experience can both be considered under the general term of prior knowledge.

Specific events. Reading teachers have long believed that children require adequate background knowledge to understand discourse, but systematic attempts to investigate its influence are relatively recent. Such attempts stem from the work of Schank (1972), who devised script units. Working in the area of artificial intelligence, Schank's script units served as standardized memory units which contained information on a particular topic and expectations about how that information is generally used.

A study by Gordon, Hansen and Pearson (Note 9), investigated the influence of prior knowledge on the reading comprehension of second grade children. After pretesting to assess prior knowledge of spiders, children read a selection on spiders. Immediately following, children were required to answer 12 post-test questions, six of which were defined as textually explicit (requiring responses directly from the text) and six of which were defined as scriptally implicit (requiring responses related to the text but answerable only on the basis of prior knowledge). Children with high pretest scores also obtained high post-test scores. The researchers noted that not only is prior knowledge necessary but that the reader needs the ability to relate prior knowledge to text information, for the effect of prior knowledge was found to be more pronounced for implicit questions, than for explicit questions.

Research which borrowed heavily from Schank's construct was Pace's (Note 10) study of kindergarten, second, fourth and sixth graders. After devising stories about highly familiar situations: "shopping in a supermarket" and "making a peanut butter and jelly sandwich"; less familiar situations: "playing checkers," and "growing vegetables in a garden"; and unfamiliar situations: "making lye soap" and "making a lithograph," script lists which consisted of a sequence of actions defining each situation were drawn up. Each child was required to tell all he knew about a situation and responses were compared with a script list. Then the child listened to either an explicit story version, which contained all the essential information, or an implicit story version, which deleted information that was implied by, or could be inferred from, remaining sentences. Ten questions (six script questions and four passage questions) were then asked of each child.

In part, Pace's results suggest that the variable of prior or script knowledge may affect the comprehension of young children more than it does older children. When comprehension scores were adjusted for script knowledge, kindergarten subjects correctly answered significantly fewer questions about less familiar stories, both on explicit and implicit story versions. Pace concluded that "if they lack requisite knowledge about an event, younger children's comprehension of a story about that event seemingly will suffer" (p. 11). Subjects at fourth and sixth grade levels made fewer errors on explicit story forms than on implicit story forms, indicating that having at one's disposal all of the essential information in a story aids comprehension of that story. Lewis's (Note 11) study of the effect of prior subject matter knowledge and text structure variation on the recall of information by undergraduate college students, also noted the decline in importance of prior knowledge for adult readers.

Rothkopf (1978) sees the background of experience which the reader possesses as standing in a reciprocal relationship to processing which the reader undertakes: "This point of view implies that different equalities of processing are required with different degrees of instruction-relevant experience in order to achieve instructional success" (p. 465).

Schemas. Comprehending and recalling information from discourse involves the use of a system for relating new information to the reader's present world of experience. Bartlett (1932) referred to such interpretative systems as schemata. Norman and Rumelhart (1975) called the systems conceptual frameworks. Kintsch (1974) referred to them as schemas, and Schank's (1972) scripts represented a parallel notion.

Bartlett's (1932) studies of adults' memory for stories, after periods of time extending even over a decade, are often quoted as the origins of this type of research. After examining distortions contained in recall of stories, specifically "The War of the Ghosts," a story which has been used extensively in more recent memory for prose research, Bartlett noted that each individual appeared to try to make sense of new situations in the text, in terms of experiences which had been encountered in the past. It was the bodies of knowledge built on past experiences and situations which Bartlett termed schemata (pp. 199-214).

Several recent researchers have studied young children's use of some kind of organizational framework to guide recall of simple picture stories (Brown, 1975; Kintsch, Note 1). Difficulty with exposition by young children probably accounted for recall differences in Brown's (1975) study of young children's memory for the order of events in a story. Story retention was measured by free recall or by non-verbal reconstruction using a series of pictures. Whereas second grade children were able to recall and reconstruct the correct story order, kindergarten children were not as capable in the recall task.

Such schemas are unique to the individual and are more obvious when recall of long texts is required. Binet and Henri (1894, quoted by Brown, 1975) studied recall differences in children aged between eight and thirteen years. Children retained underlying ideas as opposed to verbatim information, when recalling long texts, and reconstructed these ideas with syntactic and lexical forms more characteristic of their own speech.

The notion of a schema as an anticipatory framework that prepares the perceiver to receive certain kinds of information and not others, has also been developed by Neisser (1976). He sees schemas to be not only "plans for perceptual action [but] readiness for particular kinds of structure" (p. 21).

The role of the schema in the perceptual cycle is diagrammed in Figure 2.2. The schema becomes ready for further information by directing exploration. Newly assimilated information, in turn, modifies the original schema. Because schemas are developed by experience and everyone's experiences are different, the schemas which the individual develops are unique. However, as Neisser points out:

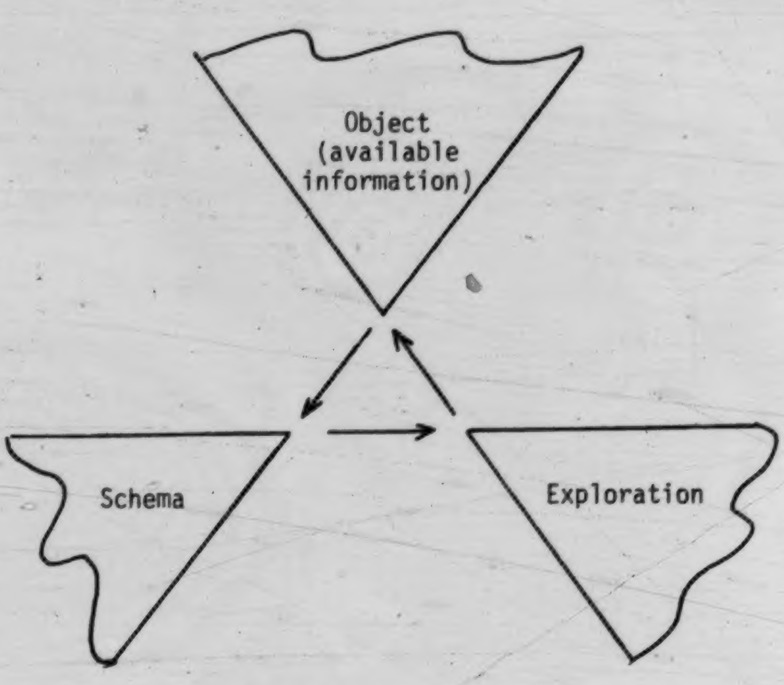

Object
(available
information)
Schema
Exploration

Figure 2.2

The Role of the Schema in the Perceptual Cycle
(From Figure 2, Neisser, 1976, p. 21)

> The worlds we have lived in are not so different after all, and our initial schemata equipped each of us to notice some of the same things . . . Our shared experience does not include only the physical environment. To the extent that we live in a coherent culture, we have encountered a more or less standardised set of social experiences as well . . . We develop anticipations of common behavior in the same way that we develop anticipations of other events, and we perceive them in the same cyclic way. These culturally established schemata mediate our perception of other people's behavior, and also underlie that behavior itself. They reflect just the level of predictability that culture requires and creates: not enough to tell anyone's fortune, but enough to get through the day. (Neisser, 1976, pp. 187-188)

Summary. Research on the influence of prior knowledge on the comprehension and recall of text has involved systems for analyzing how much a reader knows about the subject of the text and how well the reader is able to relate what he reads to what he knows. Several studies have suggested that the importance of prior knowledge for the reader may decline with age (Pace, Note 10; Lewis, Note 11).

Inference

Inference is the ability used by the reader to interpret what the writer has said in a current sentence, or to predict future text sentences by relating current text information to earlier text information, prior knowledge and task demands while reading. Such an activity is by no means simple. Indeed, Frederiksen et al. (Note 12) state "discourse inferences result from a complex interaction of discourse characteristics with the prior knowledge and expectations of a language user" (p. 1).

One difficulty encountered in attempting to survey research on discourse inference is the variety of definitions which has been developed. In general most definitions cover at least two types of inference. There is one which connects new information in text to previously read text information (backward-looking inferences, Schank, 1975; McLeod, 1978; connective inferences, Frederiksen et al., Note 12; enabling inferences, Hildyard, Note 5; text-connecting inferences, Omanson, Warren and Trabasso, Note 4; presuppositional and consequential inferences, Paris and Lindauer, 1976; Paris and Upton, 1976). There is another, which takes the information given so far in the text and predicts a plausible further state or action (forward-looking inferences, Schank, 1975; McLeod, 1978; extensive inferences, Frederiksen et al., Note 12; pragmatic inferences, Hildyard, Note 5; slot-filling inferences, Omanson, Warren and Trabasso, Note 3). In addition, Frederiksen et al. (Note 12) added structural inferences, which build an organizational framework, a coherent model of the text as a whole, that often has a conventionalized structure, e.g., a story or a logical argument (pp. 5-6). This framework approaches the definition of schema as outlined in the previous section.

Despite the diversity of definition, research studies of children's inferencing abilities have provided valuable information. Studies by Paris and Lindauer (1976), Paris and Upton (1976), Omanson, Warren and Trabasso (Note 4), Hildyard (Note 5), and Pace (Note 10) suggested that the ability to inference may be developmental in nature. Young children often fail to recognize inferences to process sentences unless deliberately told to do so (Paris & Lindauer, 1976; Paris & Upton, 1976; Pace, Note 10). Inferencing strategies, and, in particular, text-connecting inferencing, separate proficient from less proficient readers (McLeod, 1978). However, further studies of inference generation, with controlled task and text variables, are needed to replicate such results.

Task Demands and the Reader's Active Involvement

Task demands. Early assessments of the effects of different task demands on the comprehension and recall of specific sentences and of discourse could be judged as non-reading experiments. This is because experimental tasks were employed which represented a continuum of depth of processing in terms of task meaningfulness. They ranged from counting letters in words, to giving the subject intentional memory instructions and inventing sentences to follow given sentences. Not all tasks were reading tasks. However, such studies showed that pertinent instructions before reading enhanced comprehension and recall of text (Mistler-Lachman, 1974; Schallert, 1976).

A recent study by Zimmer (Note 8) assessed the effects of orienting tasks on short term retention of prose. This study also sought to determine if a continuum of efficiency of orienting activities for encoding existed and if certain activities enhanced retention more than others. Ninety-four undergraduate students were randomly assigned to one of eight study conditions, differing according to the orienting task provided, as follows:

1. Surface Feature Task: subjects, uninformed of the posttest, estimated a random number of spelling errors while reading.

2. Reading Control: Incidental: subjects, uninformed of the posttest, read as a materials validation exercise.

3. Reading Control: Intentional: subjects, informed of the

posttest, read passages as carefully as possible.

4. Superordinate Question Task: subjects responded to superordinate level multiple choice questions interspersed throughout text passages.

5. Superordinate Statement Review Task: subjects used superordinate level statements following each specific statement passage, as review exercises.

6. Superordinate Organizer Task: subjects were given superordinate level statements preceding passages and were asked to use them as organizers for reading subordinate paragraphs.

7. Semantic Evaluation Task: subjects were asked to rate each superordinate level statement as to its helpfulness in understanding or organizing a preceding specific level passage.

8. Logical Evaluation Task: subjects were asked to rate superordinate level statements as to whether or not each statement was a valid conclusion of a previously read statement array.

Fifty four-sentence paragraphs, each consisting of a superordinate level sentence and three subordinate sentences, were used as text passages. Following task completion, a 72 item multiple choice test was administered.

Test performance differences for the eight varying conditions indicated the possibility of a hierarchy of processing tasks from most meaningful (No. 8) to least meaningful (No. 1). These results support the notion that task demands affect encoding strategies which, in turn affect retention, and parallel Craik and Tulving's (1975) results "which sustain the inclusion of a contextual or processing activity component in future models of prose memory" (p. 4).

The active involvement of the reader. Another series of studies emphasized the reader as an active processor, recalling the meaning expressed in a sentence, as opposed to the original syntactic form presented (Sachs, 1967), and integrating meaning across sentences (Bransford & Franks, 1971; Bransford, Barclay & Franks, 1972; Kintsch & Monk, 1972; Haviland & Clark, 1974). Meaning in text is also integrated, by the reader, with contexts such as pictures and text titles (Dooling & Lachman, 1971; Bransford & Johnson, 1972; Peng & Levin, Note 13) and with prior knowledge (Gordon, Hansen & Pearson, Note 9; Pace, Note 10).

The active involvement of the reader of text is also noted by Barthes (1970) as he comments on the "reader as writer":

> To read a narrative continuum is in fact to arrange it . . . at the quick pace set by the reading material . . . in a variety of structures, to strive for concepts and labels which more or less sum up the profuse sequence of observations. To read is to prepare in one's mind . . . that very moment as one 'devours' the story . . . for adjustment in concept, and constantly to reduce the novelty of what one has read to familiar concepts which, in turn, have resulted from the vast pattern of previous reading . . . To read is to classify, and this is why one could go so far as to say that to read is to write at least with reference to certain modern texts. (p. 9)

Summary. Research has indicated that more "reading-related" tasks and more "meaningful" tasks in terms of the reader's purpose for reading result in higher retention of text information.

Text Structure

Early specifications of similarity and difference in discourse were centred on measures of readability which included surface text features such as vocabulary rarity and density, and sentence length. Text structure research is concerned with the way an author has organized the content of a text in order to convey or communicate a message. Comprehension and recall are influenced by how one perceives the structure that ties sentences together, or the non-existence of such structure (Johnson, 1970; Rumelhart, 1975; Mandler & Johnson, 1977).

Within the field of reading, differences between narrative and explanatory prose, such as the absence of character and plot in an explanatory prose passage, have been known to produce differential text understanding (Harris & Smith, 1971; Karlin, 1975). The causes of recall differences due to text structure variation have been noted, but not often elaborated. Recent studies of comprehension and recall of varying text structures have attempted to do just this.

Studies of varying text structure have been concerned with identifying similarities and differences in prose passages and also evaluating the presence or absence of structure in what is remembered after reading or listening to text.

Identifying text structure. There are a number of differences in procedures developed for analyzing text structure. Several procedures identify the function of ideas as organized by the author (Meyer, 1975; Rumelhart, 1975; Kintsch and van Dijk, 1976; Stein & Glenn, 1977). Another identifies concepts within the text and arranges them hierarchically according to frequency of occurrence and sentence order (Crothers, 1972). Meyer's (1975) system shows how some ideas in a text are subordinate to other ideas. It also shows the relationships among these ideas, and labels are provided in the structure to classify such relations. A series of rules hierarchically arranges the content from text into tree structures. Nodes in the tree structure contain content words from the text, while lines between nodes show how the text is organized spatially.

Similarly, Rumelhart's (1975) grammar, to account for the structure of simple stories, uses a series of rules to organize hierarchically content from text. Several researchers have used and modified the original grammar (Thorndyke, 1975; Gentner, 1976; Mandler & Johnson, 1977; Stein & Glenn, 1977). The rules for the grammar used in this study include modifications made by Thorndyke (1975). These rules are outlined below and summarized in Figure 2.3.

Rule 1: A story is comprised of a setting, a theme, a plot and a resolution.

Rule 2: A setting is comprised of the time and place of a story, as well as an introduction to its main characters.

Rule 3: The theme focuses in on the story plot and, as Thorndyke states, "is often a stated or implied goal for the main character to achieve" (Thorndyke, 1975, p. 33). An event is optional in the statement of a theme, or several events may accompany the goal to indicate a theme of a passage.

Rule 4: The plot of a story consists of a number of episodes.

Rule 5: Episodes have three components: a subgoal, attempts, and an outcome. In the following passage, the components are noted:

Episode: "Bell also made a receiver with a thin sheet of metal. The different amounts of electricity made an electromagnet pull

Rule Number	Rule
1.	STORY → SETTING + THEME + PLOT + RESOLUTION
2.	SETTING → CHARACTERS + LOCATION + TIME
3.	THEME → (EVENT)* + GOAL
4.	PLOT → EPISODE*
5.	EPISODE → SUBGOAL + ATTEMPT* + OUTCOME
6.	$\text{ATTEMPT} \longrightarrow \begin{cases}\text{EVENT*}\\\text{EPISODE}\end{cases}$
7.	$\text{OUTCOME} \longrightarrow \begin{cases}\text{EVENT*}\\\text{STATE}\end{cases}$
8.	$\text{RESOLUTION} \longrightarrow \begin{cases}\text{EVENT}\\\text{STATE}\end{cases}$
9.	$\left.\begin{array}{l}\text{SUBGOAL}\\\text{GOAL}\end{array}\right\} \longrightarrow \text{DESIRED STATE}$
10.	$\left.\begin{array}{l}\text{CHARACTERS}\\\text{LOCATION}\\\text{TIME}\end{array}\right\} \longrightarrow \text{STATE}$

"+" indicates the combination of elements in sequential order.

"*" indicates that the element may be repeated.

( ) parentheses, i.e. (EVENT), indicate the element may be optional.

Figure 2.3

Grammar Rules for Simple Stories
(From Thorndyke, 1975, p. 32)

the sheet of metal towards itself. The sheet vibrated and Bell heard voice sounds" (from experimental materials developed for this study).

Subgoal: The subgoal may be inferred by the reader and is not always stated in the text. In the passage episode above, the subgoal is "Making a Receiver." This is subordinate to the major goal of "Carrying the voice using electricity."

Attempts: In this episode, attempts are direct actions aimed at the achievement of the subgoal (Rule 6).

Outcome: The outcome is the result of the attempts to achieve the subgoal. In this case, the outcome of making the receiver is the sheet vibrating and Bell hearing voice sounds. The outcome may be an event or a state (Rule 7).

Rules 8, 9: The resolution is the final result of the story with respect to the theme. It may be an event or a state. In the episode above, the resolution is also the outcome of the previously mentioned episode: "Bell heard voice sounds." The reason for Bell's first telephone words also forms part of the story resolution: "Bell's first telephone words were a cry of help. He had spilled acid over his clothes."

Rule 10: The resolution may also include a statement about the components of the setting in which the action of the resolution takes place.

Kintsch (1974) also devised a system to classify the function of ideas as organized in text. His system defines three aspects of meaning which are assumed to be processed when comprehending text.

Understanding a text initially involves understanding word concepts which appear as lexical entries in semantic memory.

Secondly, certain rules govern the ordering of word concepts to form propositions. Propositions are units of meaning which can take truth values. Thirdly, propositions are related to one another by one of two rules: Firstly, one proposition is connected to another proposition if the two propositions share an argument. (An argument is one kind of word concept.) Secondly, propositions are ordered according to their relative importance in the text. Thematic propositions which tend to correspond to what has previously been termed main ideas are Level 1 propositions, and, as such, are high in the content structure hierarchy of propositions. Propositions which share an argument with a Level 1 proposition are directly subordinated to it, and are termed Level 2 propositions. Lower level propositions correspond to details in text (Kintsch, 1974; Kintsch & van Dijk, 1975, pp. 108-109).

Kintsch's system is adequate for representing short sets of propositions. However, it lacks the ability to adequately describe the internal structure of text in the detail present in Rumelhart's model. As Thorndyke states:

> Most commonplace narrative discourses contain additional structuring in the plot sequence involving problems facing a character, intent and motivation in actions, and some comparison of event outcomes to the initial problem. (Thorndyke, 1975, p. 18)

Kintsch's argument repetition rule does display the temporal ordering of some interrelated events but not all causal connections can be shown.

In this study, a combination of Kintsch's system for analyzing text and Rumelhart's grammar for simple stories, as modified by Thorndyke, was used to enumerate the ideas present in text and in subjects' recalls of text. In addition, the researcher developed a classification for DESCRIPTIVE INFORMATIONAL prose, similar to Rumelhart's distinctions for story parts. The areas of enquiry for which these analysis systems were used are described in Chapter V. A more detailed summary of Kintsch's analysis system as outlined by Turner and Greene (Note 14) is found in Appendix A.

A more recent modification of Rumelhart's (1975) story grammar is that developed by Stein and Glenn (1977). Their story grammar specifies the variety of causal links occurring between episodes in a story. In addition it details the structural variations which can occur within a single episode. Neither had been outlined by Rumelhart. Such modifications in the light of further research studies underline the precision with which more recent studies are being developed and are steps toward the development of more theoretical positions about the reader as processor.

Evaluating what has been remembered. What is understood about the relationship of text structure to the processes of comprehension and recall is guided by the methods used to assess them.

Thorndyke (1977) assessed the effect of varying the degree of plot structure in a story on a person's memory for that story. Plot structure was used to refer to elements of a story which made the story coherent. They included the story theme, the intent of actions performed by characters, and resolution of the original problem.

Subjects were presented with passages which represented two stories with one of four possible conditions of plot structure, ranging from a narrative form which stereotyped the story structure to a structure with very little narrative organization provided by temporal or causal sequencing. In addition, sentence order for each condition could be either NORMAL or RANDOM. RANDOM passages were formed by randomly permuting sentences within each of the conditions.

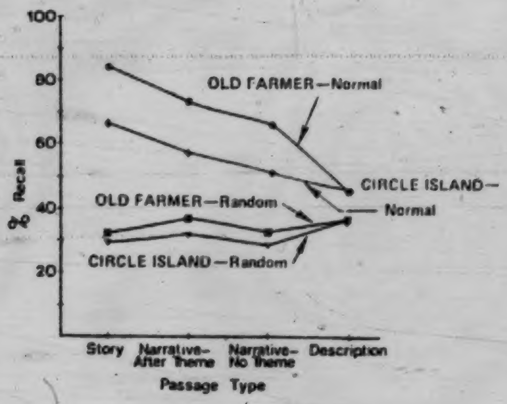


Figure 2.4

Mean Recall with Decreasing Text Structure
(From Thorndyke, 1977, p. 89)

Mean recall decreased with decreasing amounts of structure in the material for NORMAL presentations. For RANDOM presentations, recall was not affected by the structural variable. Memory and comprehension were best when the text matched up readily with a standard known story schema (Thorndyke, 1977, pp. 83-98).

Gentner (1976) analyzed a passage using two different methods: an analysis of serial structure based on the serial ordering of sentences in the passage, and an analysis of a story structure based primarily on causal relations within the passage. Although the serial structure of the passage was found to influence recall of the passage, later recalls were found to be more in accordance with the story structure of the passage.

A study by Meyer (1975) showed that texts with identical structures but different content produced similar patterns of recall. This method of evaluating what has been remembered by comparing text structure and recall structure, was used in a further study by Meyer, Brandt and Bluth (Note 6) to describe how ninth graders identified and utilized text structures to remember. They also examined whether or not signals provided by an author explicitly stating the top-level structure in the hierarchy of the content structure of the passage, facilitated recall and use of the author's organizational structure. For most high comprehenders, use of the author's text structure for organization of recall was evident. It was also evident for about half of the average comprehenders but for few of the low comprehenders. For all passages and all recall conditions, use of the author's text structure, or schema, was the best predictor for recall. Signalling was not found to influence the recall strategies of high comprehenders, but for some low comprehenders, signalling aided immediate recall but not delayed recall.

Readers must be familiar with the general structural organization of different text types, and then be able to select from personally-known structures, the one which best matches the author's text structure as embodied in a particular text. Such a principle corresponds with a cogent definition of comprehension provided by Ross (1974):

> One perceives what is meant, when and to the degree that the internal representation of the message (whether in concepts, beliefs, imagination or abstract thought), approximates the objective representation prescribed by the syntactical and semantical relationships of the units of the signal. (p. 112)

Neisser's (1976) notion of a culturally-shared schema is also relevant here. An individual's perception of text will never be the exact image of another's perception of text. However, because of the nature of shared experiences in life, our perceptions of text are similar in many ways. Such a notion not only underlies the basis for methods of analyzing text but also the global concept of communication. The ideas which the author seeks to communicate are dependent on the notion of a culturally-shared experience for their reception.

These studies have all emphasized the importance of text structure for comprehension and recall. Whereas the assessments for these studies have compared the structure of subjects' recalls with the structure of the original passage, more recent research has asked the question: "What part of a text structure is recalled with greater frequency than other parts of text structure?" In a study of organizational processes in text comprehension by Kintsch and Kozminsky (1977), undergraduate college students recalled almost twice as much material from the first quarter of the story as from the third, when the stories were divided into quartiles, in both reading and listening conditions. A story grammar specifies the type of information which is expected in a story sequence. Stein (Note 15) showed that when children heard stories in the normally expected sequence, certain categories of

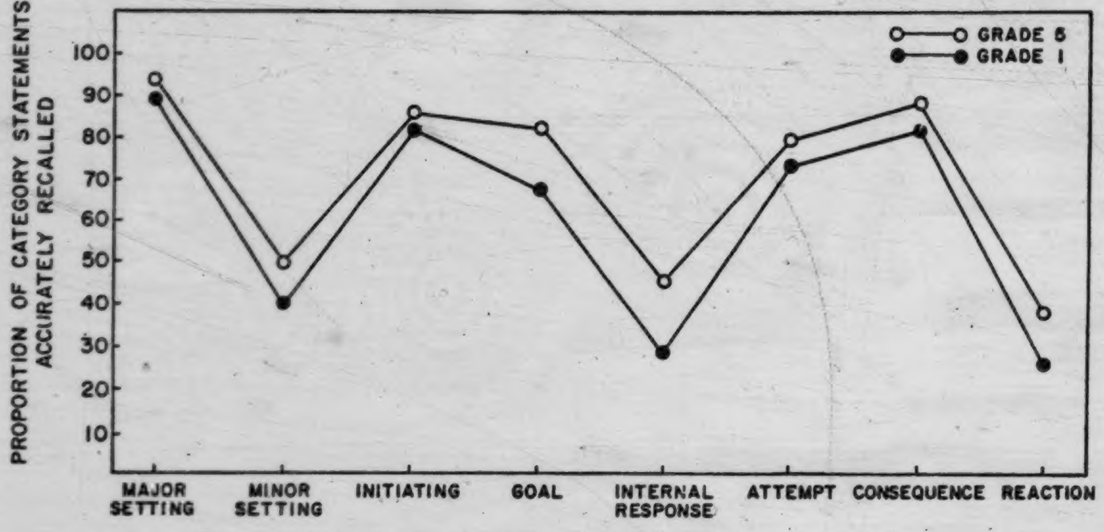


Figure 2.5

Salience of Each Story Grammar Category
(From Figure 3, Stein, Note 15, p. 53)

information were always recalled more frequently than other categories. Setting statements introducing the protagonist, initiating events and consequence statements were recalled most frequently. (See Figure 2.5.) Korman's (1944) study of the retelling abilities of Moscow preschoolers noted that generally, young children departed from the story line of the original text in two ways. They were "jumps ahead" which consisted of omissions of one or more episodes and "regressions" during storytelling, to initially omitted episodes.

This study will assess recall frequencies when texts differing in structure are divided into three parts. STORY NARRATIVE texts will be divided into sections, viz., (1) Setting and Theme and Goal, (2) Plot, (3) Resolution. DESCRIPTIVE INFORMATIONAL texts will also be divided into sections, viz., (1) Topic Identification, (2) Topic Expansion, (3) Conclusion Statements.

Several groups of studies have been carried out by researchers attempting to validate their particular system or grammar for analyzing text structure.

Kintsch et al. (1975) provided an empirical foundation for Kintsch's theory of the representation of meaning by identifying some content variables which significantly affect comprehension of narrative and memory. In one study, texts were constructed which controlled the number of propositions in a text base but varied the number of different word concepts used as arguments of propositions. In other words, a text base consisting of eight propositions may use three word concepts repeatedly as arguments of different propositions. Another text base consisting of eight propositions may use seven different word concepts

---

1 (LOVE, GREEK, ART)
2 (BEAUTIFUL, ART)
3 (CONQUER, ROMAN, GREEK)
4 (COPY, ROMAN, GREEK)
5 (WHEN, 3, 4)
6 (LEARN, ROMAN, 8)
7 (CONSEQUENCE, 3, 6)
8 (CREATE, ROMAN, 2)
Arguments: GREEK, ART, ROMAN (3)

Text: The Greeks loved beautiful art. When the Romans conquered the Greeks, they copied them, and, thus, learned to create beautiful art. (21 words)

Figure 2.6

The Greek Art Paragraph: Short,
Few Different Arguments

---

1 (BUILD, BABYLONIAN, GARDEN)
2 (BEAUTIFUL GARDEN)
3 (LOCATION: ON, GARDEN, HILL)
4 (PLANT, BABYLONIAN, FLOWER)
5 (LOVELY FLOWER)
6 (CONSTRUCT, BABYLONIAN, FOUNTAIN)
7 (DESIGN, BABYLONIAN, PAVILION, 8)
8 (HAS, QUEEN, PLEASURE)
Arguments: BABYLONIAN, HILL, GARDEN, FLOWER, FOUNTAIN,
PAVILION, QUEEN, PLEASURE (8)

Text: The Babylonians build a beautiful garden on a hill. They planted lovely flowers, constructed fountains and designed a pavilion for the queen's pleasure. (23 words)

Figure 2.7

The Babylonian Paragraph: Short,
Many Different Arguments

(From Kintsch et al., 1975, pp. 198-199) as arguments with fewer repetitions. The first text talks about the same few things, while the second talks about many different things: Which is harder to read and remember?

For these short paragraphs, reading times were longer for the text containing many, different arguments:

Table 2.1

Mean Reading Time in Seconds for Short History Texts

	Number of Different Arguments	
	Few	Many
Short, history	9.41	10.22

Recall for the text containing many, different arguments was slightly less than for the text containing few, different arguments:

Table 2.2

Mean Number of Propositions Recalled and Percent Recall for Short History Texts

	Number of Different Arguments	
	Few	Many
Short, history	5.44 (65%)	4.79 (59%)

(From Kintsch et al., 1975, pp. 201-202)

Thus when the number of propositions and the number of words in texts are controlled, and the number of arguments in propositions varies, arguments can be seen to affect recall of text. (See Figures 2.6, 2.7; Tables 2.1, 2.2.)

In summary, Kintsch et al. (1975) found that:

The number of propositions in a text base is an important determinant of the rate with which text may be comprehended and the amount recalled from a given text.

Text bases with many different word concepts as arguments of propositions, require more processing than text bases with few different word concepts, irrespective of the number of propositions.

Reading time is a function of the number of propositions processed as indexed by immediate recall. Each proposition processed added about one second to the total reading time. Superordinate propositions are recalled best of all serial positions in the text (Kintsch et al., 1975, pp. 196-214).

Summary. The variable of text structure has been shown to have an important influence on the comprehension and recall of text. The availability and utilization of a relevant text schema, be it a story narrative schema or an exposition schema, has been shown to enhance retention of text propositions, and may even be a prerequisite for adequate utilization of other variables such as prior knowledge or the generation of inferences.

Many studies of text structure have dealt with adults' and children's retention of narrative. Many different ways of qualitatively analyzing narrative have also been devised, with some commonalities. Methods of analysis help to conceptualize further the process of comprehension in children and adults. Findings of research are providing new questions and seeding a vigorous field of enquiry into comprehension. Reading educators have noted the importance of familiarity with different types of text structure (Harris & Smith, 1972; Karlin, 1975) but it has been from outside the reading field, in related disciplines, such as psychology, that much knowledge of text structure has developed.

III. METHODS OF ASSESSING WHAT IS REMEMBERED FROM TEXT

In part, what is understood about the processes of comprehension and recall is guided by the methods used to assess them. Many studies of comprehension of text have used free recall in an assessment of what is retained after reading. Differing methods of qualitative analysis have shown that readers recall the more general, thematic information units from text (Kintsch, 1976; Kintsch et al., 1975; DeFratis Evans, 1977). In addition the availability and utilization of a text structure schema has been shown to increase recall (Brown, 1975; Thorndyke, 1975; Meyer, Brandt & Bluth, Note 6). However, the ability to recall passage information orally has been shown to be developmental (Brown, 1975) and possibly not the best indicator of a child's comprehension of text (Omanson, Warren & Trabasso, Note 4).

Free recall has been categorized according to superordinate and subordinate propositions (DeFratis Evans, 1977), molar and molecular units (Zimiles & Kuhns, Note 3), and new and old information (Clements, 1976; DeFratis Evans, 1977). These categorizations emphasize the hierarchical nature of text analyses (Kintsch, 1974; Meyer, 1975; Crothers, 1975) but often fail to account for all of the information which is recalled. By categorizing all of the utterance and not just the information which can be analyzed propositionally, more details about the strategies which a child uses to recall orally may be inferred.

Drum (Note 16) has developed four categories of recall for the encoding of all of the recall utterance of a comprehender. The four categories are:

Text Recall - Responses which repeat text propositions when compared with a hierarchical analysis of text (Kintsch, 1974). Text recall propositions which repeat template text propositions or use synonyms substantiated by the Concise Oxford Dictionary are included.

Text Entailed Recall - Responses which summarise information from two or more text propositions or make explicit (i.e., text connecting) inferences derived from text.

Text Evoked Recall - Responses which are peripheral to information in text propositions, related thematically to the topic but with no other connection. Generalizations with no specific text relationships.

External Recall - Responses which are related to the act of retelling rather than to the information contained in the template text.

Drum was able to define specific recall patterns using this categorization. Able readers recalled more text and text entailed information and were able to recall information from all parts of a passage. Less able readers did one of two things: they either stated a text proposition and then repeated it, or they stated an idea and elaborated on it without relationship to the template text.

The problems of the free recall task in underestimating what children know about stories has been indicated by Omanson, Warren & Trabasso (Note 4). Recognition measures of comprehension such as multiple choice questions (Zimmer, Note 8); differentiating between explicit, implied and intrusive statements (Sachs, 1967; Bransford & Franks, 1971; Kintsch & Bates, 1977; Hildyard, Note 5; Meyer, Brandt & Bluth, Note 6), and the ordering of pictures (Brown, 1975; Kintsch, Note 1) have also been used to gauge retention from text and differentiate between types of text retained.

Probed-recall measures such as question answering (McLeod, 1978; Omanson, Warren & Trabasso, Note 4) have been used to study the specific comprehension-related abilities of readers and listeners, i.e., inference generation.

Asking children what they know about what they remember and how they remember after reading might also be a useful source of information related to the understanding of the comprehension process (Brown, 1975, pp. 110-113).

Summarizing what has been remembered (Kintsch & Kozminsky, 1977) presents the researcher with details of organization strategies used by comprehenders when given the time and correction strategies which are generally not available during oral recall.

Each method of assessment brings certain quantification difficulties and the method of assessment needs to be chosen in light of the variable being studied, the population being utilized, and the information being sought.

IV. SUMMARY

The detailed study of discourse comprehension has blossomed during the 'seventies. This chapter ~~has~~ endeavoured to review research on comprehension dependent variables: viz. prior knowledge, inference, task demands and text structure, within a framework of current memory theories.

Memory and comprehension are seen in many tasks to be inextricably related. The dependence of control processes in memory on the same variables which reading researchers claim, comprehension depends, confirms this statement. Because an assessment of what is remembered depends on what has been understood, there seems to be little use in separating the terms. Brown (1975) quotes several sources who endorse the argument that memory is fundamentally inseparable from other higher mental processes such as perception, comprehension, inference, language and problem solving skills (p. 104).

Central to the ideas discussed is the notion that prose can be organized according to the way ideas are related or structured within a text.

The studies surveyed alluded to the importance of a schema or conceptual framework for organizing and recalling of narrative prose passages. Kintsch (Note 1) demonstrated that even four year old children appear to use a type of organizational framework when recalling simple picture stories.

At the upper elementary level, children are increasingly required to read and remember information from prose. A cursory examination of textual materials indicates that examples of informational prose are organized differently to examples of simple narratives. Karlin (1975) noted that informational prose intended for children of a given grade was more difficult than narrative prose for children of the same grade. Could it be that children have a schema or organizational framework for stories and lack a schema for informational prose? Further, could the lack of a schema for informational prose impede the understanding and recall of informational prose as it is found in content area texts at the upper elementary school level?

One of the major aims of this study is to test the versatility of Kintsch's propositional analysis system by extending its use to the analysis of descriptive informational prose. With a few exceptions (Meyer, 1975; Gentner, 1976; Cornish, 1978), most studies of prose learning have used simple stories as stimuli.

This study compares free recall behaviors of proficient sixth grade readers after reading texts differing by structure but similar in content, in an attempt (1) to gauge recall differences due to structure and (ii) to test the adequacy of Kintsch's system for ordering the ideas within prose.

Variables which will be compared between text structures (i.e., STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose), and within content topics (i.e., NERVE CELLS, TELEPHONE texts) include types of propositions recalled, hierarchical levels of propositions in recall, proportions of propositions in recall, and position of propositions in recall.

A system for categorizing all of the free recall of a subject, developed by Drum and Lantaff (Note 7) will be used to further describe what is retained after reading.

The exigencies of the free recall task have been noted. However it was decided to use this type of task to simplify the research design. Interview questions were used to further probe children's organizational and recall strategies.

Chapter 3 outlines the general experimental design for the study. Chapter 4 describes the way in which experimental texts were developed for the study. A discussion of procedures, results and conclusions for the six specific areas of enquiry which comprise the study is to be found in Chapter 5.

CHAPTER 3

THE EXPERIMENTAL DESIGN

The purpose of this chapter is to present the experimental design and procedures used to compare free recall protocols of sixth grade proficient readers after reading texts differing by structure, i.e. STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose. Three experimental techniques governed the construction of the texts and the analysis of the recall protocols of readers in both immediate and delayed situations (Kintsch, 1974; Thorndyke, 1975; Drum & Lantaff, Note 7).

I. DESIGN OF THE STUDY

The study was conducted in two stages. The first involved a survey of science content area texts used in upper elementary grades and the development and pilot testing of experimental texts.

The second stage consisted of the administration of experimental texts to a sample of 32 students and the recording of free recall data which was later transcribed and analyzed. This involved two test sessions with each student. During the first session, each subject read and recalled two passages differing in topic and structure. During the second session, each subject was required to recall the passages they had read and recalled a week earlier, and to answer several questions regarding what they did to remember.

Sample

One hundred and forty sixth grade proficient readers were drawn from 12 suburban schools within the Edmonton Public School System. These schools were selected for the study by the system's departmental research officer to represent a cross-section of the schools in different geographic and socio-economic areas served by the 118 elementary schools in the system. From this sample, subjects were selected for the main study and for pilot study tasks.

The subjects were identified as sixth grade proficient readers by their scores on the Stanford Achievement Test: Reading Subtests, which placed them at or above the 77th percentile on both tests of vocabulary development and reading comprehension.

Reading educators have noted the increased emphasis on content area reading in comparison to the reading of narrative in upper elementary grades (Harris & Smith, 1972; Karlin, 1975). Heilman (1972) stated:

> . . . There is a diminished emphasis upon teaching the language tools that are needed for 'mining' all the subjects, and an air of urgency about having pupils accumulate facts in various subject areas. (p. 416)

For this reason, it was decided to use sixth grade children as subjects. Children in sixth grade have been reading DESCRIPTIVE INFORMATIONAL prose for several years. If organizational differences are to be found in the structures of recall protocols of children, they would most likely be found in the recall protocols of proficient readers who are experienced at reading both STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose. Further research of a similar nature but including subjects of differing age and grade levels, may give some indication of the developmental nature of the effects of structural differences in prose. However, this study is limited to the differences evidenced within the sample selected.

Thirty-two sixth grade proficient readers for the second stage of the study were drawn from the sample pool of subjects described above. Equal numbers of girls and boys were chosen. A description of the subjects is found in Table 3.1

Table 3.1

Mean Reading Subtest Achievement Scores of Subjects
Chosen for Experimental Tasks

			Stanford Achievement Test: Reading Subtests Percentile Scores	
Sex	No.		Vocabulary	Comprehension
Female	16	= 32 subjects	$\overline{X}$ = 90.3125	$\overline{X}$ = 92.4375
Male	16		s = 6.1305	s = 4.6770

Test Instruments

Sample selection instrument. As mentioned above, the subjects were identified by their scores on the Stanford Achievement Test: Reading Subtests, which placed them at or above the 77th percentile on both tests of vocabulary development and reading comprehension.

The Stanford Achievement Test: Reading Subtests are designed to measure comprehension and vocabulary development. Internal test consistency, measured by split-half reliability co-efficients (corrected by the Spearman-Brown formula) and the Kuder-Richardson formula, reveals reliability coefficients for word meaning and paragraph meaning subtests ranging between .89 and .93 at Grade 5 and 6 levels. To ensure content validity, test authors examined courses of study and textbooks as a basis for determining the skills, knowledge and understandings to be measured (Kelly et al., 1964).

Researcher-developed texts. Four experimental texts were used to answer the research questions and to test the null hypotheses developed for this study. The texts were written about two content topics, i.e. NERVE CELLS and TELEPHONE. For each content topic, two texts differing in structure were developed, i.e. STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL. Thus, the four experimental texts were: NERVE CELLS STORY NARRATIVE, NERVE CELLS DESCRIPTIVE INFORMATIONAL, TELEPHONE STORY NARRATIVE, and TELEPHONE DESCRIPTIVE INFORMATIONAL. The methods used to construct these texts are described in Chapter 4.

Each passage was typed, double spaced, on a single sheet of paper and mounted on a separate card folder. On the outside of each folder, the following instructions were typed:

> Instructions: Please read the following passage at your own rate, make sure you understand it well and indicate when you have finished reading by saying 'Finished.' I will say 'START' and you may turn the page to commence. When you have finished reading you will be asked to recall the story you have read.

Administration of test instruments. The Stanford Achievement Test: Reading Subtests, had been administered by the Edmonton Public School System at the end of the 1976-77 school year and information was obtained from the school system's pupil assessment office.

Researcher-developed texts were administered by the researcher to each of the 32 subjects, individually, during the months of February, March and April, 1978. Recall tasks were required of each subject immediately following the reading of each text, and one week later.

At the commencement of each individual session in the Immediate condition, the researcher introduced herself and the reading task and discussed with the subject, favourite sports and hobbies, vacations, and school experiences. In order to exemplify the requirements of the task, each subject was required to complete a practice task, by reading the instructions outlined on the outside of the card folder (described above), and the following passage, also enclosed in a card folder.

> A dog got a piece of meat and was carrying it home in its mouth. On his way home he had to cross a plank lying across a stream. As he crossed he looked down and saw his own shadow reflected in the water beneath. Thinking it was another dog with another piece of meat, he made up his mind to have that also. So he made a snap at the shadow, but as he opened his mouth, the piece of meat fell out, dropped into the water, and was never seen again.

On completion of silent reading, which was timed with a stopwatch by the researcher, the subject recalled the story.

The subject was then handed a card folder similar to the practice passage, but containing a STORY NARRATIVE or DESCRIPTIVE INFORMATIONAL text of either NERVE CELLS or TELEPHONE content, according to the condition assigned, as described below. Immediately, the first text was recalled. Then the researcher handed the subject a second folder containing the other assigned text and a similar reading and recall procedure ensued.

The free recall of each text was recorded on a Hitachi portable cassette recorder with a built-in microphone (Model TRK-5110H). The portable cassette recorder was placed several feet in front of the subject. The researcher sat to the subject's left, within easy access of the recorder controls.

One week later, each subject was asked to recall both texts. If the previous event could not be recalled, the researcher provided text titles, i.e., NERVE CELLS or TELEPHONE, but nothing else.

Assignment of subjects to experimental conditions. Subjects were assigned to a within-subject block design with independent variables of text structure and text content as outlined in Table 3.2.

Overview of Research Procedures

The study was divided into two stages. The first stage is discussed in Chapter 4.

The second stage was divided into six areas of enquiry:

1. Text Recall
2. Categories of Recall
3. Types of Propositions in Recall
4. Hierarchical Levels of Information in Recall
5. Position of Information in Recall
6. Metamemorial Strategies.

Each of these will be discussed separately in Chapter 5.

Statistical Analyses

All programs used for statistical analysis of the data were obtained through the Department of Educational Research Services,

Table 3.2

Assignment of Subjects to Experimental Conditions
(This block design was repeated to accommodate 32 subjects)

		Stories		Structures		
		N = NERVE T = TELEPHONES		SN = STORY NARRATIVE DI = DESCRIPTIVE INFORMATIONAL		
Subject	Sex	Trial 1	Trial 2	Trial 1	Trial 2	Code for Description
1	M	N	T	SN	DI	1 M - NSN - TDI
2	F	T	N	SN	DI	2 F - TSN - NDI
3	M	T	N	DI	SN	3 M - TDI - NSN
4	F	N	T	DI	SN	4 F - NDI - TSN
5	M	T	N	SN	DI	5 M - TSN - NDI
6	F	T	N	DI	SN	6 F - TDI - NSN
7	M	N	T	DI	SN	7 M - NDI - TSN
8	F	N	T	SN	DI	8 F - NSN - TDI
9	M	T	N	DI	SN	9 M - TDI - NSN
10	F	N	T	DI	SN	10 F - NDI - TSN
11	M	N	T	SN	DI	11 M - NSN - TDI
12	F	T	N	SN	DI	12 F - TSN - NDI
13	M	N	T	DI	SN	13 M - NDI - TSN
14	F	N	T	SN	DI	14 F - NSN - TDI
15	M	T	N	SN	DI	15 M - TSN - NDI
16	F	T	N	DI	SN	16 F - TDI - NSN

Faculty of Education, University of Alberta, Edmonton, Alberta. The program specific to each area of enquiry will be discussed within the relevant section in Chapter 5.

CHAPTER 4

CONSTRUCTION OF MATERIALS FOR EXPERIMENTAL TASKS

I. A SURVEY OF SCIENCE TEXTS

One of the research questions which guided the implementation of this study asked about differences in the ways ideas are organized in STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose to which elementary school children are exposed. A decision was made to limit this search to a study of prose in the area of science materials used by sixth grade elementary students.

Science texts and reference encyclopedias written for children at the sixth grade level were studied in order to gauge structural differences. Following is a list of texts which were surveyed:

Asimov, I. *Asimov's biographical encyclopedia of science and technology*. New York: Doubleday, 1964.

Bethell, J. *The how and why wonder book of famous scientists*. New York: Wonder Books, 1964.

Brandwein, P. F., Cooper, E. K., Blackwood, P. E., & Hone, E. B. *Comprehensive program for concepts in science*. New York: Harcourt, Brace and World, 1966.

Childcraft: The how and why library. *How things work* (Vol. 7). *How we get things* (Vol. 8). Chicago: Field Enterprises Educational Corporation, 1977.

Compton, F. E. *Compton's encyclopedia and fact index* (22 vols.). Chicago: Author, 1972.

Fischler, A. S., Lowrey, L. F. & Blanc, S. S. *Science: A modern approach*. New York: Holt, Rinehart and Winston, 1966.

Science Year: World Book Science Annual, 1971-1977. Chicago: Field Enterprises Educational Corporation, 1977.

Siedel, F. & Siedel, J. M. Pioneers in science. Boston: Houghton Mifflin, 1968.

World Book Encyclopedia (22 vols.). Chicago: Field Enterprises Educational Corporation, 1977.

Young Children's Encyclopedia (16 vols.). Chicago: Encyclopedia Brittanica, 1970.

Of all the passages surveyed, one difference was notable. Some passages included, with the explanation of a particular scientific process, information about the author of the process. In other passages this biographical information was omitted. Another feature of the latter type of passage was found to be the lack of temporal or causal continuity between passage sentences.

The former passages were categorised as STORY NARRATIVE passages. Such passages gain cohesion by the temporal and causal links among events and ideas developed in a passage. They also contain a plot structure. The plot structure of a passage involves the identification of a main character, a setting, a problem facing a main character, a sequence of attempts by a main character to solve the problem, and an eventual resolution of the problem. Several researchers have developed plot structure definitions similar to this (Rumelhart, 1975; Thorndyke, 1976; Stein & Glenn, 1977).

DESCRIPTIVE INFORMATIONAL passages, as the latter passages were named, are often comprised of a series of attribute statements. Bereiter (Note 17) labels this type of passage as "process" (p. 14). Process resembles narrative in being concrete and temporally ordered, but it lacks plot structure. DESCRIPTIVE INFORMATIONAL passages which describe a process require the child to make "an active effort to create a connected mental representation and to test this mental representation for sufficiency" (pp. 13, 14).

In order to determine the passages to be used in the main study, pilot studies were undertaken.

II. PILOT STUDY ONE

Purpose

The purpose of the first pilot study was to have sixth grade children rate passages written by the researcher, on a content familiarity scale. This was done in order to eliminate those topics which would be adequately recalled because of extensive prior knowledge of the passage content and with little dependence on passage information. Studies have indicated that younger children tend to depend more on prior knowledge of a particular topic when recalling after reading, than do older children or young adults (Pace, Note 10; Lewis, Note 11). However, controlling for the variable of prior knowledge at the outset of the study was felt to make results more directly attributable to the variable of structure which was of central importance. Drum and Lantaff (Note 7) commented on the recall of "The War of the Ghosts" (Bartlett, 1932) and the Biblical story, "Joseph and His Brothers" (Kintsch et al., 1975) by able readers:

> [They] constructed interpretations that fitted the culturally acquired preconceptions of what must have been in the stories rather than what was. Presumably a competent reader who had never heard the Joseph story would have confined his construction to the text information. (p. 2)

As Spiro (1977) states:

> If subjects are keeping a discourse isolated from prior knowledge, it is not surprising that the greatest directing

> force would be exerted by endogenous factors rather than one's pre-existing knowledge structure. (p. 141)

Subjects

Seventy children from three sixth grade classrooms in three suburban schools of the Edmonton Public School System rated the passage topics for content familiarity. Thirty-three children read and rated the STORY NARRATIVE passages, and 37 children read and rated the DESCRIPTIVE INFORMATIONAL passages.

Materials

Passages for this study were constructed after both STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose forms. The main structural difference between the two forms was the use of plot structure to develop the STORY NARRATIVE passages. Initially, STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL passage forms were devised for each of five topics. These topics were: BATS, NERVE CELLS, LIGHT, ELECTRICITY, and TELEPHONES. Each passage was checked using the Dale-Chall Readability Formula (Dale & Chall, 1948) to indicate an initial standard degree of text difficulty. Each passage was rated at or below the 5-6 grade level of difficulty and were, therefore, assumed to be within the easy reading range for sixth grade proficient readers. A summary of the information is provided in Table 4.1, and a copy of the passages appears in Appendix B.

Propositional analyses of initial passages. In addition to the control of readability which guided the final choice of texts for experimental tasks, initial passages were analyzed according to

Table 4.1

Passage Readability Information

Text Variables	BATS St Narr	BATS Desc Inf	NERVE CELLS St Narr	NERVE CELLS Desc Inf	LIGHT St Narr	LIGHT Desc Inf	ELECTRICITY St Narr	ELECTRICITY Desc Inf	TELEPHONES St Narr	TELEPHONES Desc Inf
Number of Words	133	118	153	145	115	111	133	134	139	134
Number of Unfamiliar Words	10	10	14	12	11	6	12	14	9	9
Number of Sentences	14	10	12	11	13	12	11	11	15	13
Average Sentence Length (wds.)	9.5	11.8	12.8	13.2	8.8	9.3	12.1	12.2	9.3	10.3
Corrected Grade Placement (Dale & Chall, 1948)	5-6	5-6	5-6	5-6	5-6	4th Gr. & below	5-6	5-6	5-6	5-6

Kintsch's propositional analysis system (Kintsch, 1974), formalized by Turner and Greene (Note 14). A summary of this analysis procedure is found in Appendix A. Text bases for experimental texts are found in Appendix C.

Using this system, the following information was obtained from the ten initial passages:

1. Number of propositions in the text base: For each passage, the number of propositions into which the passage was analyzed, was given.

2. Number of different arguments in the text base: Kintsch et al. (1975) discussed the effect on recall of the number of different word concepts used as arguments of propositions. When the number of propositions in two text bases are the same, and the number of arguments in the two text bases are different, recall for the text base containing many different arguments was slightly less than for the text containing few different arguments. The second text would talk about the same topic elaborating it in different ways, whereas the first text would talk about many different topics.

3. Number of arguments shared by STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL forms of the same topic: If the number of arguments shared by STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL forms is high, then the passages can be said to be similar in content. If the number of shared arguments is low, then differences in recall of passage content cannot be attributable to structural differences. This information is summarized in Table 4.2.

Table 4.2

Propositional Analyses of Passages

Propositional Analysis Variables	BATS		NERVE CELLS		LIGHT		ELECTRICITY		TELEPHONES	
	St Narr	Desc Inf	St Narr	Desc Inf	St Narr	Desc Inf	St Narr	Desc Inf	St Narr	Desc Inf
1. No. of propositions in the text base	64	51	59	60	46	42	48	52	46	49
2. No. of different arguments in the text base	35	30	41	31	28	24	23	23	28	29
3. No. + % of arguments shared by differing passage forms	19 54.3	19 63.3	22 53.7	22 70.9	10 35.7	10 41.6	15 65.2	15 65.2	16 57.1	16 55.1

Procedures

Copies of one or the other version (STORY NARRATIVE or DESCRIPTIVE INFORMATIONAL) of the five passage topics were distributed to a whole class of students. The following directions were given to each class:

> You have in front of you five short passages. After you have read all five passages, I want you to think about the topic of each passage. Which one do you know most about? Give that passage a score of 1. Which passage do you know almost as much about as the first one? Give that passage a score of 2. Continue scoring the texts until you come to the one you know very little about. Give that text a score of 5. Each text should have a different score. Think carefully about the score you have given each passage. Thanks for your help.

If the children were puzzled by these instructions, individual instructions were given to those who requested clarification of the task.

Results

The passages were all found to be adequate to a 5-6 level except for the LIGHT DESCRIPTIVE INFORMATIONAL passage, which was simpler (4 and below). Propositional analysis of passages indicated that NERVE CELLS, ELECTRICITY and TELEPHONE passage forms were similar in terms of analysis variables. The number of propositions in the text base differed from STORY NARRATIVE to DESCRIPTIVE INFORMATIONAL forms by 1, 4 and 3 propositions in NERVE CELLS, ELECTRICITY and TELEPHONE respectively.

The number of shared arguments in differing passage forms was high for all three topics, indicating that the content for differing passage forms (i.e., STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL) was similar.

Given these passages to rate according to how familiar they were with the content of each of the passages, sixth grade children rated NERVE CELLS and ELECTRICITY topics as least familiar, and therefore these topics would control best for content familiarity or prior subject matter knowledge. Table 4.3 is a summary of how topics were rated according to differing prose forms.

Table 4.3

Content Familiarity of Passages

	STORY NARRATIVE		DESCRIPTIVE INFORMATIONAL	
		Total Rank Score		Total Rank Score
Least known	NERVE CELLS	127	NERVE CELLS	139
↓	ELECTRICITY	100	ELECTRICITY	121
↓	LIGHT	96	LIGHT	105
↓	TELEPHONE	92	TELEPHONE	101
Best known	BATS	80	BATS	89

This rating information, combined with data on initial passage variables which has been described above, was used to select experimental texts. It was noted that the structure of prose did not affect the rating of content topics. Both STORY NARRATIVE passages and DESCRIPTIVE INFORMATIONAL passages were rated in the same way, with NERVE CELLS being the least known topic, and BATS being the best known topic.

III. PILOT STUDY TWO

Purpose

The second pilot study was used to select passages for experimental tasks, to practice data collection procedures and to devise a system for categorizing recall protocols.

Subjects

Fifteen sixth grade proficient readers were randomly selected from the sample pool selected for the main study.

Materials

The passages described and used in Pilot Study One were used in Pilot Study Two. A copy of each of the passages can be found in Appendix B.

Procedures

Each subject was required to read and recall two passages, one in the STORY NARRATIVE form and one in the DESCRIPTIVE INFORMATIONAL form, and both differing according to topic. The recall protocols were divided into a series of categories which will be described below. Propositional analyses were completed on passage-specific information recalled. These lists of propositions were compared with the propositional text bases of the initial passages. Recall proportions were tallied for each subject.

Categorizing recall propositions. Each subject's response was divided into passage-specific recall and non passage-specific recall. Passage-specific recall was analyzed according to Kintsch's

(1974) propositional analysis system. For the purpose of the Pilot Study, non passage-specific recall was deleted.

Passage-specific information. Each recall was then categorized according to the categories described below:

1. CORRECT - The relation and arguments of the proposition recalled are the same as the relation and arguments of the corresponding template text proposition. In certain instances a synonym used for a relation or an argument was counted as correct. e.g.

TEMPLATE (QUALITY OF, METAL, SHEET) RECALL (QUALITY OF, METAL, PIECE)

2. GENERALIZED ARGUMENT - The argument of the recall proposition is a generalized representation of the original template argument. The recall proposition was also categorized as generalized argument if part or one case category, present in the template, was missing from the recall proposition. e.g.

TEMPLATE (BECOME, A:MICHAEL FARADAY, G:WELL-KNOWN)
RECALL (BECOME, A:MAN, G:FAMOUS)
TEMPLATE (BURN, A:$, O:(QUALITY OF, THREAD, SEWING), G:ASH)
RECALL (QUALITY OF, ASH, BURNT)

3. GENERALIZED RELATION - The relation of the recall proposition is a generalized representation or an underspecified representation of the original template text relation. e.g.

TEMPLATE (DROP, A:$, O:(QUALITY OF, FILINGS, IRON))
RECALL (PUT, A:$, O:(QUALITY OF, FILINGS, IRON))

4. INFERENCE - The recall proposition implies or is implied by template text propositions.

5. ELABORATION - The recall proposition adds fullness of

detail which is probably correct but is not directly associated with template text information, and more likely to be associated with the reader's prior knowledge.

6. ERROR - The proposition is incorrect. (From Turner & Greene, Note 14, pp. 76-77).

The computation of proportions of passage information recalled, involved the addition of categories 1, 2 and 3. It was decided that due to the nature of categories 4, 5 and 6, propositions so categorized could not be included as recall propositions.

Results

An inspection of proportions of propositions recalled from initial passages indicated the relatively small proportion of information recalled in each passage when the categorization system outlined above was used. Later research, following the pilot study, led to the implementation of a more detailed system for categorizing recall protocols, and one which had been used experimentally (Drum & Lantaff, Note 7; Drum, Note 16). This is described in Chapter 5.

However, this analysis did indicate recall differences between STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL forms. With three topics, namely, NERVE CELLS, LIGHT and TELEPHONE, mean propositional recall was proportionately higher for STORY NARRATIVE forms than for DESCRIPTIVE INFORMATIONAL forms. When within-subject comparisons were made, 12 of the 15 subjects recalled proportionately more of the STORY NARRATIVE form than the DESCRIPTIVE INFORMATIONAL form, regardless of topic. Results are summarized in Table 4.4.

Table 4.4

Mean Proportions of Propositions Recalled:
Pilot Study Two

BATS		NERVE CELLS		LIGHT		ELECTRICITY		TELEPHONES	
SN*	DI	SN	DI	SN	DI	SN	DI	SN	DI
20.31	31.34	25.56	16.97	36.23	19.04	20.1	23.69	29.62	14.49

* SN = STORY NARRATIVE
DI = DESCRIPTIVE INFORMATIONAL

In addition, recall proportions for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL forms of the BATS topic should be noted. This content topic was rated as best known by all raters in Pilot Study One. However, mean recall proportions for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL structures were the opposite to those mentioned for NERVE CELLS, LIGHT and TELEPHONE topics. Mean recall was higher for the DESCRIPTIVE INFORMATIONAL version of the BATS topic than for the STORY NARRATIVE version. It may be that the variable of structure is less crucial for understanding and recall when the content of the text is familiar to the reader.

Several decisions arose from the pilot studies and preliminary analyses. These will be outlined below.

IV. DECISIONS ARISING OUT OF THE PILOT STUDIES AND PRELIMINARY ANALYSES

1. On the basis of the results discussed above, it was decided to use NERVE CELLS and TELEPHONE topics. ELECTRICITY passage forms were similar in terms of analysis variables and were rated as

relatively unfamiliar, but showed little differentiation in terms of proportions of propositions recalled.

2. It was decided to incorporate the categories suggested by Drum and Lantaff (Note 7) in addition to propositionally analyzing text recalls. In this way, all of a subject's response would be accounted for and not just those segments which could be equated with template text propositions. The earlier categorization system developed by Turner and Greene (Note 14) did not accommodate the total response.

3. Useful information about children's metamemorial strategies could be discovered if interview questions were used. The questions to be used were modified to the following:

a. What do you think were the main differences between these two passages?

b. What did you do to remember these two passages?

c. Which passage did you remember better?

d. Why?

4. Passage titles kept recurring in pilot study recalls. The titles often summarized succinctly the detail of the passages. This interfered with passage recall because one could never be sure if the individual was summarizing the passage or recalling the heading, or both. Thus, passage titles were deleted to avoid this confusion.

5. Task familiarity was noted as a problem. Children said they felt they performed better on the second passage in that they were more familiar with what was expected. A warm-up task, which consisted of the child reading and recalling a short narrative passage was

inserted before the actual experimental task.

6. To avoid tension-building silences once the child had finished reading a passage, it was decided to ask: Q "Anything else?" giving a subject an opportunity for closure or continuation of recall.

V. INTERJUDGE AGREEMENT—PROPOSITIONAL ANALYSIS OF EXPERIMENTAL TEXTS

Following a decision to use NERVE CELLS and TELEPHONE passages a panel of four graduate students in reading (three PhD students including the researcher and one Master of Education student) met. After training in the use of the propositional analysis (Kintsch, 1974; Turner & Greene, Note 14) the panel met four times to establish final analyses for the four texts which were used in the major study.

Inter-judge agreement between the researcher and the three other graduate students ranged from 1.00 for NERVE CELLS STORY NARRATIVE and TELEPHONE DESCRIPTIVE INFORMATIONAL texts to .97 for the NERVE CELLS DESCRIPTIVE INFORMATIONAL text and .989 for the TELEPHONE STORY NARRATIVE text. The procedures for determining the rate of agreement were developed by Arrington (1932) and used by Feifel and Lorge (1950). Responses (in this case, propositions) in the panel's analyses which agreed with the researcher's analyses (doubling the agreements) were divided by this total plus the disagreements.

$$\text{i.e.} \quad \frac{2 \times \text{agreements}}{2 \times \text{agreements} + \text{disagreements}}$$

In the NERVE CELLS DESCRIPTIVE INFORMATIONAL text, considerable discussion was held over the analysis of the statement:

". . . there was no way of knowing what a nerve cell looked like."

The researcher had analyzed it thus:

		Levels	
	1	2	3
Proposition 34	(EXIST, WAY)		
35		(KNOW, NO ONE, 34)	
35		(POSSESS, NERVE CELL(2), APPEARANCE)	
37		(CONCEIVE, $, 36)	
38		(PURPOSE:TO, 35, 37)	

The panel had analyzed it thus:

		Levels	
	1	2	3
Proposition 34	(EXIST, WAY)		
35		(NEGATE, 34)	
36		(KNOW, $, 35)	
37		(CONCEPTUALIZE, $, NERVE CELL(2))	
38		(PURPOSE:TO, 36, 37)	

and thus:

	1	2	3
Proposition 34		(APPEAR, NERVE CELL(2))	
35	(KNOW, $, 36)		
36		(NEGATE, 34)	
37		(REFERENCE, 36, WAY)	

The decision was made to use the researcher's original analysis because of ease of retransformation from propositional analysis to text.

In the TELEPHONE STORY NARRATIVE text, agreement was not reached over the researcher's analysis of the following statement:

> ". . . he (Bell) found a way to carry the voice using electricity."

This was analyzed (CARRY, A:1 (i.e. Alexander Graham Bell), I:ELECTRICITY, O:VOICE). The panel argued that Bell did not actually carry the voice, and arrived at the following analysis:

(CARRY, $, I:ELECTRICITY, O:VOICE).

However, the decision was made to use the original analysis due to Fillmore's definition of the agent case category which states that the agent is the typically animate instigator of the state or action identified by the verb (Turner & Greene, 1977). In this case, it was felt, Bell was the instigator of the carrying of the voice by electricity.

The use of the repetition rule, which assigns propositions to specific levels within the text hierarchy, was also a source of dispute. However, most questions discussed by the panel were resolved.

VI. FURTHER ANALYSES OF EXPERIMENTAL TEXTS

After final propositional analyses of texts had been completed, further information was gleaned which supported the choice of experimental texts.

a. Proportions of proposition types in each text. Proportions of predicate propositions, modifier propositions and connective propositions present in each text were calculated. The following table and figure suggest similarity in terms of frequency of occurrence of proposition types represented across passages.

Table 4.5

Experimental Texts: Frequency of Occurrence of Proposition Types

	Predicate Propositions	Modifier Propositions	Connective Propositions
NERVE STORY NARRATIVE	28/59 .48	19/59 .32	12/59 .20
NERVE DESCRIPTIVE INFORMATIONAL	28/60 .47	18/60 .30	14/60 .23
TELEPHONE STORY NARRATIVE	23/46 .50	9/46 .20	14/46 .30
TELEPHONE DESCRIPTIVE INFORMATIONAL	23/49 .47	15/49 .31	11/49 .22

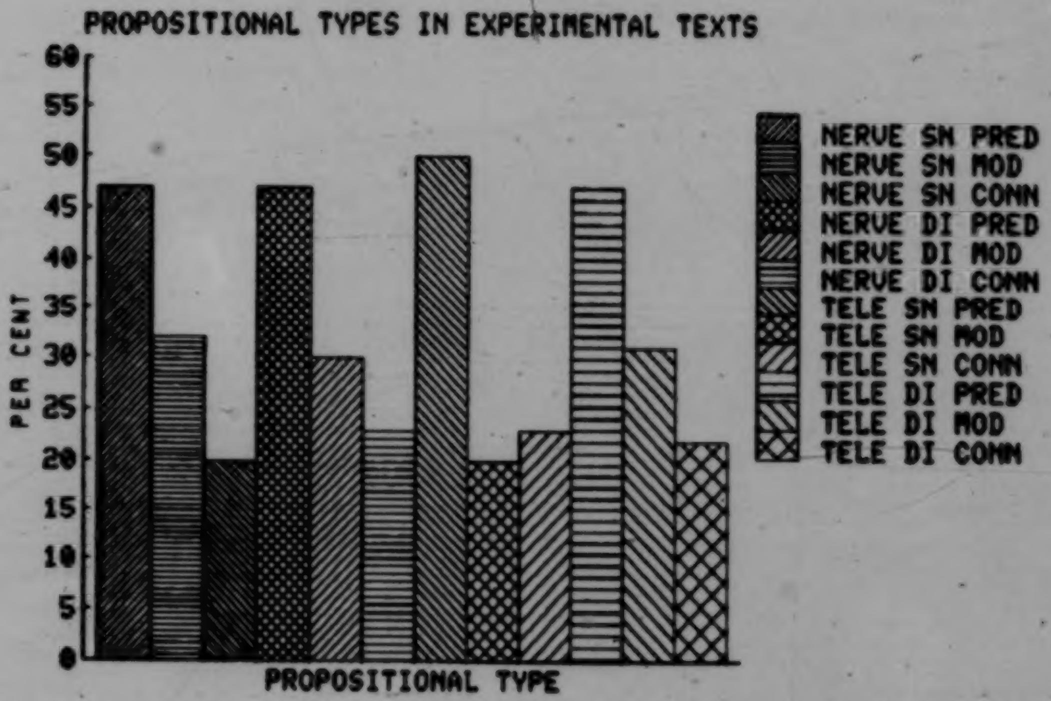


Figure 4.1

Frequency of Occurrence of Proposition Types in Experimental Passages

b. Proportions of propositions present at each hierarchical level in the text. Each text was analyzed into a hierarchy of propositions consisting of six levels. These levels were contracted into high (levels 1,2), medium (levels 3, 4) and low (levels 5, 6) levels. The following table indicates the distribution of propositions according to levels in the text hierarchy:

Table 4.6

Experimental Passages: Distribution of Propositions According to Levels in the Text Hierarchy

	High	Medium	Low
NERVE STORY NARRATIVE	36/59 .6102	21/59 .3559	2/59 .0339
NERVE DESCRIPTIVE INFORMATIONAL	48/60 .8000	12/60 .2000	0/60 .0000
TELEPHONE STORY NARRATIVE	26/46 .5652	20/46 .4348	0.46 .0000
TELEPHONE DESCRIPTIVE INFORMATIONAL	32/49 .6531	15/49 .3061	2/49 .0408

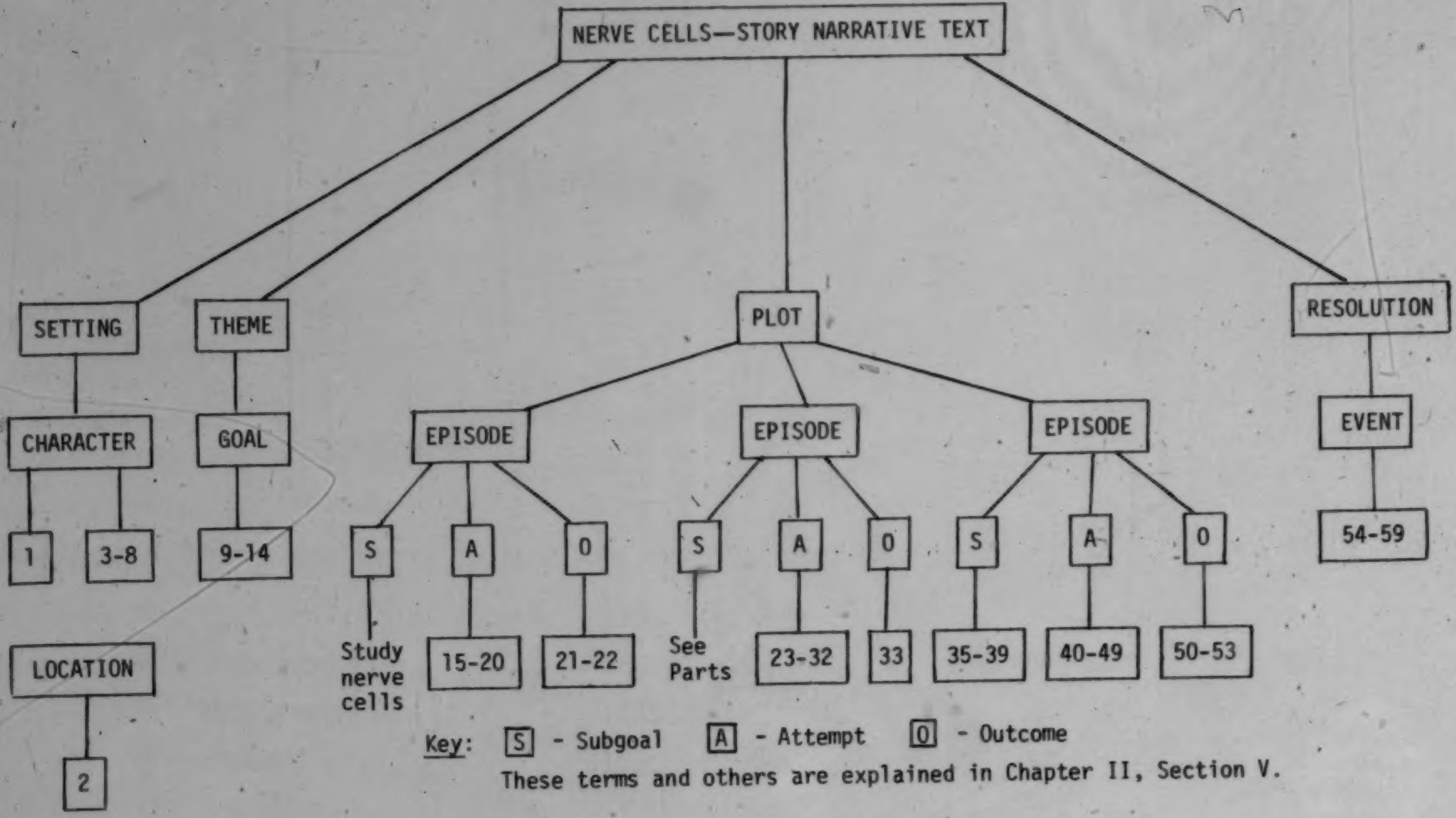
c. Proportions of propositions within specific text parts. Texts were divided into three sections according to the structural organization representations shown in Figures 4.2, 4.3, 4.4, 4.5 (Kintsch & Kozminsky, 1977; Glenn, 1977).

STORY NARRATIVE passages were divided into

Section i. Setting and Theme

Section ii. Plot

Section iii. Resolution.


NERVE CELLS—STORY NARRATIVE TEXT
SETTING
THEME
PLOT
RESOLUTION
CHARACTER
GOAL
EPISODE
EPISODE
EPISODE
EVENT
1
3-8
9-14
S
A
O
S
A
O
S
A
O
54-59
LOCATION
Study nerve cells
15-20
21-22
See Parts
23-32
33
35-39
40-49
50-53
2

Key: S - Subgoal A - Attempt O - Outcome

These terms and others are explained in Chapter II, Section V.

Figure 4.2

Structural Organization of NERVE CELLS STORY NARRATIVE Text

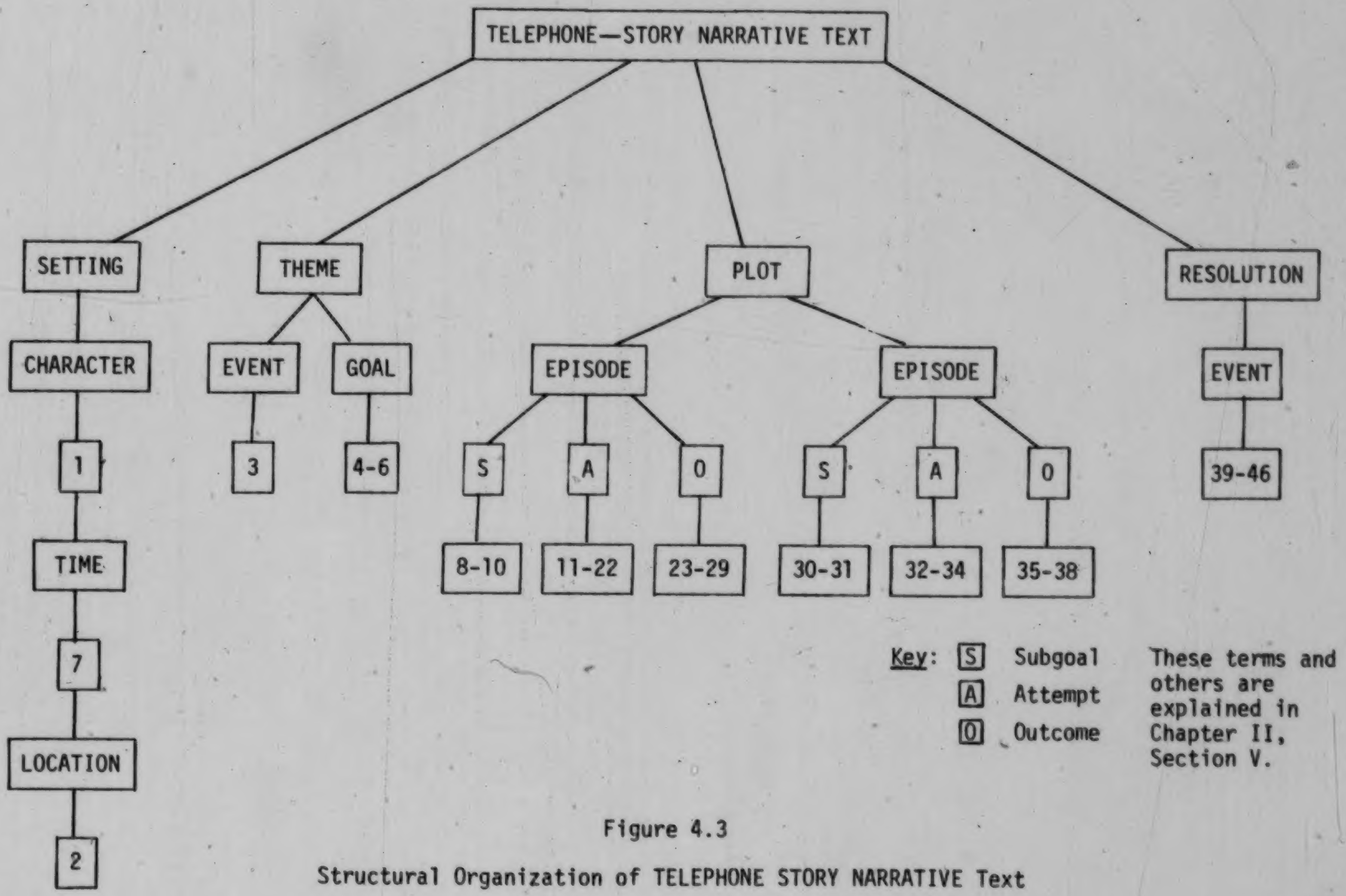

TELEPHONE—STORY NARRATIVE TEXT
SETTING
CHARACTER
1
TIME
7
LOCATION
2
THEME
EVENT
3
GOAL
4-6
PLOT
EPISODE
S
8-10
A
11-22
O
23-29
EPISODE
S
30-31
A
32-34
O
35-38
RESOLUTION
EVENT
39-46
Key: S Subgoal
A Attempt
O Outcome
These terms and others are explained in Chapter II, Section V.

Figure 4.3

Structural Organization of TELEPHONE STORY NARRATIVE Text

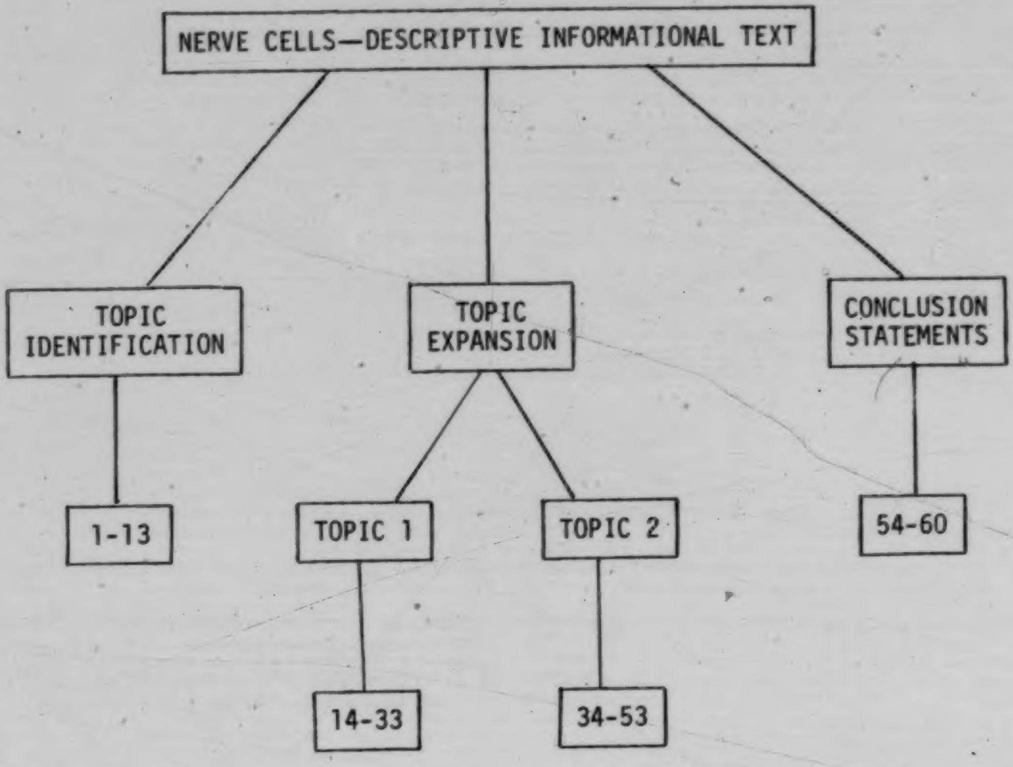

NERVE CELLS—DESCRIPTIVE INFORMATIONAL TEXT
TOPIC IDENTIFICATION
TOPIC EXPANSION
CONCLUSION STATEMENTS
1-13
TOPIC 1
TOPIC 2
54-60
14-33
34-53

Figure 4.4

Structural organization of NERVE CELLS DESCRIPTIVE INFORMATIONAL Text

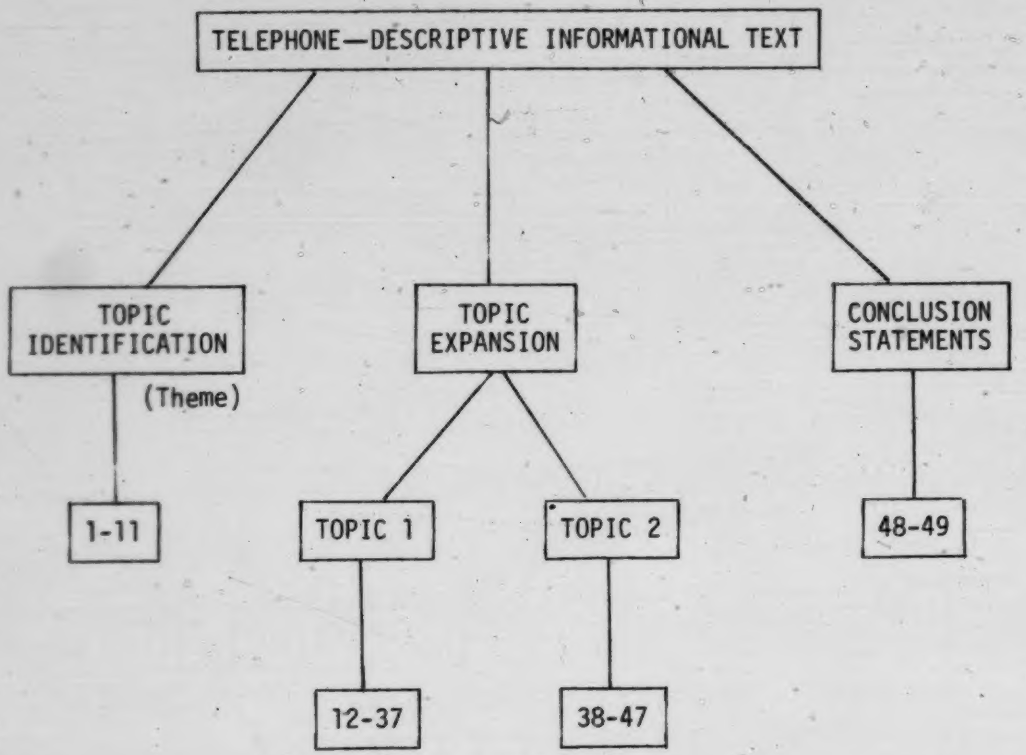

TELEPHONE—DESCRIPTIVE INFORMATIONAL TEXT
TOPIC IDENTIFICATION
(Theme)
TOPIC EXPANSION
CONCLUSION STATEMENTS
1-11
TOPIC 1
TOPIC 2
48-49
12-37
38-47

Figure 4.5

Structural Organization of TELEPHONE DESCRIPTIVE INFORMATIONAL Text

DESCRIPTIVE INFORMATIONAL passages were divided into

Section i. Topic identification

Section ii. Topic expansion

Section iii. Conclusion statements.

Proportions of propositions represented within particular sections of text are shown below (Table 4.7).

Table 4.7

Experimental Passages: Proportions of Propositions Occurring within Particular Text Sections

	Section 1	Section 2	Section 3
NERVE STORY NARRATIVE	14/59 23.73	39/59 66.10	6/59 10.02
NERVE DESCRIPTIVE INFORMATIONAL	13/60 21.67	40/60 66.67	7/60 11.67
TELEPHONE STORY NARRATIVE	7/46 15.22	31/46 67.39	8/46 17.39
TELEPHONE DESCRIPTIVE INFORMATIONAL	11/49 22.45	36/49 73.47	2/49 4.08

These analyses indicated similarity between the four experimental texts in terms of proportions of proposition types represented, propositions represented at each hierarchical level, and proportions of propositions represented within specific text parts. Data indicated here were used to interpret recall data in later analyses.

VII. PILOT STUDY THREE

Cloze Testing

Purpose. To measure passage difficulty in yet another manner, cloze tests were developed from the experimental texts, i.e., NERVE CELLS and TELEPHONE passages.

Subjects. Forty sixth grade proficient readers were selected from the pool of subjects selected for the main study.

Materials. From each experimental text, five different cloze forms were made. Each cloze form deleted a different word in the following manner:

NERVE CELLS STORY NARRATIVE Cloze Form (1) deleted the 1st, 6th and 11th word.

NERVE CELLS STORY NARRATIVE Cloze Form (2) deleted the 2nd, 7th and 12th word, etc.

Thus, with four experimental texts and five deletion forms of each experimental text, there were 20 cloze tests altogether.

STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL forms were coupled using a table of random numbers (Tuckman, 1972) (see Table 4.8) and presentations were systematically, alternately ordered. When alternate forms of NERVE CELLS and TELEPHONE cloze tests were coupled together, 10 forms of the coupled cloze tests were available. Using a table of random numbers (Tuckman, 1972), the 40 subjects were assigned, four to each of the 10 cloze test forms. A sample of two of the cloze tests used in the study, as well as the instruction page given to students, are included in Appendix C.

Table 4.8

Assignment of Cloze Test Forms

NERVE CELLS		TELEPHONE				
St. Narr.	Desc. Inf.	St. Narr.	Desc. Inf.	Paired Cloze Forms		
1(1)*	1(2)	1(4)	1(1)	1.	NN2	TI1
2(4)	2(1)	2(1)	2(4)	2.	TN3	NI3
3(3)	3(3)	3(3)	3(3)	3.	TI5	NN4
4(5)	4(4)	4(2)	4(5)	4.	NI5	TN4
5(2)	5(5)	5(5)	5(2)	5.	TN5	NI4
				6.	TI3	NN3
				7.	NI4	TN2
				8.	NN5	TI4
				9.	TI2	NN1
				10.	NI2	TN1

*The first numeral indicates the form of the cloze test (i.e., NERVE CELLS St. Narr. 1 is the STORY NARRATIVE NERVE CELLS passage made into the cloze form which deletes the first, sixth, eleventh word, etc.). The bracketed numeral is the assigned random number by which topic forms were paired.

Procedures. Cloze tests were administered to small groups of students. No one group was larger than 10 students. Each group test administration took place in a vacant classroom, was supervised by the researcher and was carried out without time constraints. The researcher read the instructions accompanying each cloze test form and clarified instructions for individuals if required.

The tests were scored by comparing the words inserted with those of the original passage. No allowance was made in scoring for synonyms (Taylor, 1953; Jenkinson, 1957; Cosens, 1974). A score was allocated which represented, as a percentage, the number of correct insertions as a ratio of the number of possible correct insertions.

Results. Scores for correct insertions on cloze forms differing by topic and structure are shown in Table 4.9.

Table 4.9

Cloze Tests: Proportion of Correct Insertions

	NERVE CELLS		TELEPHONE	
	St. Narr.	Desc. Inf.	St. Narr.	Desc. Inf.
$\overline{X}$	48.767	50.575	45.245	49.626
s	14.385	16.702	14.294	13.968
s^2	206.930	278.965	204.311	195.114

An earlier study by Bormuth (1968) determined for cloze readability tests, a set of criterion scores comparable to the criterion scores used with oral reading tests. For oral reading tests, a text is said to be at a student's instructional level if he can correctly answer 75% of test questions based on the text, and if he can correctly pronounce 95% of the words as it is read. Texts from which a student can answer 90% of test questions correctly, and pronounce 98% of the words, are said to be at the student's independent reading level. Bormuth determined comparable cloze test scores which are summarized in Table 4.10.

Table 4.10

Comparable Cloze Test Scores to Instructional and Independent Level: Criterion Scores on Oral Reading Tests
(From Bormuth, 1968, p. 193)

Criterion Scores		Cloze Test Scores
Independent Level		
Comprehension	90%	57%
Word Recognition	98%	54%
Instructional Level		
Comprehension	75%	44%
Word Recognition	95%	34%

An inspection of the mean scores obtained on cloze tests differing by topic and structure indicates that all experimental texts are within the instructional reading level of the subjects in the sample but may be a little more difficult than initial readability scores suggested. Graphing the mean cloze scores revealed interesting information in terms of proportions of correct insertions for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL structural types. Cloze tasks failed to produce higher scores on STORY NARRATIVE texts as is hypothesized with recall tasks. In actual fact, the opposite occurred.

Subjects were more able to replace deletions correctly in DESCRIPTIVE INFORMATIONAL texts. (See Figure 4.6.)

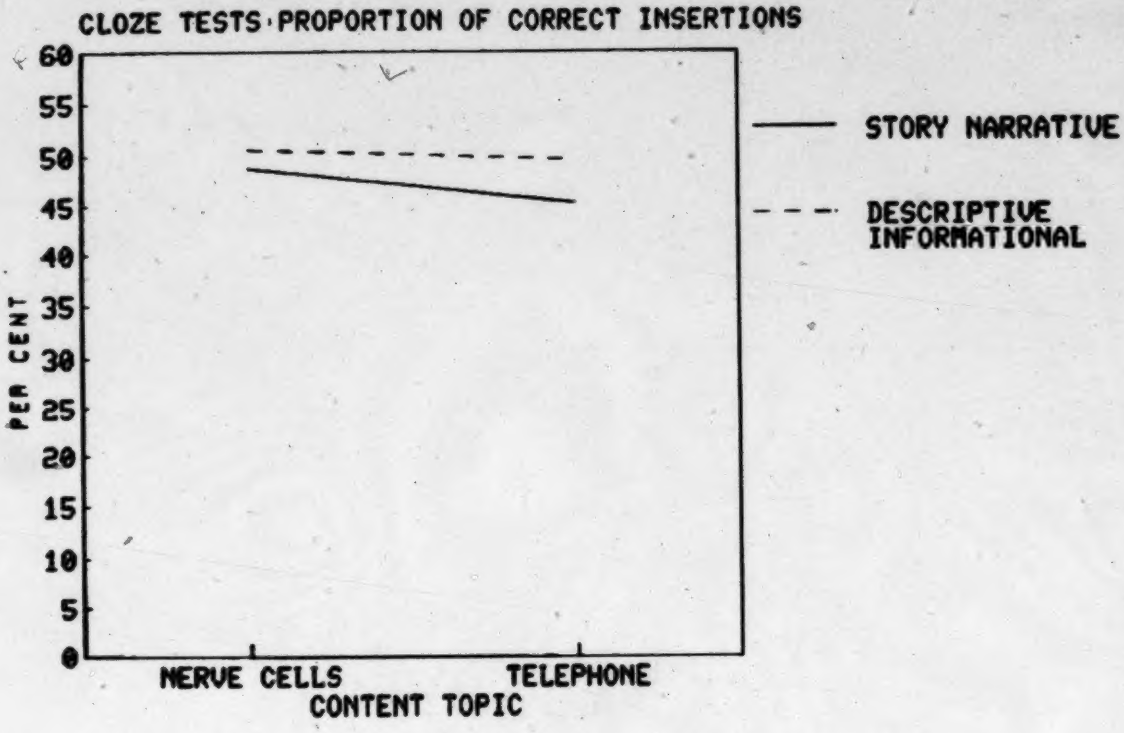


Figure 4.6

Mean Cloze Scores

VIII. SUMMARY

This chapter provided an explanation and description of the construction and selection of initial and experimental task passages.

The three pilot studies aided in the selection of experimental texts and provided guidelines and suggestions for the implementation of the main study.

Further analyses of experimental texts described the similarities between texts.

CHAPTER 5

EXPERIMENTAL TASKS, FINDINGS, DISCUSSION

This chapter will describe in detail, the six areas of enquiry which made up the study. Each area of enquiry will be developed in terms of the purpose for the examination of the variable(s) in question, the research design, the procedures undertaken, the findings and their relevance in terms of comprehension and recall processes. The six areas of enquiry are:

1. Text Recall
2. Categories of Recall
3. Types of Propositions in Recall
4. Hierarchical Levels of Information in Recall
5. Template Text Position of Propositions in Recall
6. Metamemorial Strategies—an interview study.

For each area of enquiry, the variable will be viewed in terms of the changes which occur when the structure of text varies, i.e., with STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL forms of a particular content topic. Two content topics were utilized, i.e., NERVE CELLS, TELEPHONE, to show that results were not peculiar to one set of texts.

Experimental texts were devised as described in Chapter 4.

Assessment of Presentation Order Effects

Experimental texts and subjects' recall protocols of these texts were analyzed into hierarchical lists of propositions using procedures based on Kintsch's (1974) system for describing and ordering discourse. Propositional units found in both the template text and the recall protocol were categorized as text recall propositional units. Propositional units found in the recall protocol which summarized information from two or more template text propositions, put together specific information in new ways, or added text related or inferential information semantically entailed by the template text, were added to text recall and categorized as text plus text entailed propositional units.

To assess the effect of presentation order on recall of information, recall proportions in terms of text plus text entailed propositional units were utilized in four two factor analyses of variance. The two factors consisted of (A) presentation order and (B) text structure. Analyses were conducted for both NERVE CELLS and TELEPHONE content topics, and for Immediate and Delayed recall conditions. Tables 5.1, 5.2, 5.3 and 5.4 present summaries of the analysis of variance for NERVE CELLS Immediate recall, NERVE CELLS Delayed recall, TELEPHONE Immediate recall and TELEPHONE Delayed recall conditions respectively. Figures 5.1 and 5.2 represent graphically the recall means for (A) presentation order and (B) text structure for the analyses of variance.

In the Immediate recall condition of the NERVE CELLS texts, neither presentation order nor structure effects were significant. In the Delayed recall condition of NERVE CELLS texts, differences between mean recall proportions due to structure effects were significant, $F(1,29) = 4.047$, $p \leqslant .05$. TELEPHONE Immediate mean recall proportions in the Immediate recall condition were significantly different due to presentation order, $F(1,29) = 8.508$, $p \leqslant .01$; and structure, $F(1,29) = 10.337$, $p \leqslant .01$. In the Delayed recall condition,

Table 5.1

NERVE CELLS - Immediate Recall Condition
Summary of Analysis of Variance due to Presentation Order, STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL Text Structures

Source of Variation	SS	df	MS	F	p
Presentation Order	3.251	1	3.251	.032	0.858509
Structure	309.009	1	309.009	3.075	0.090087
Error	2914.520	29	100.501		

Table 5.2

NERVE CELLS - Delayed Recall Condition
Summary of Analysis of Variance due to Presentation Order, STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL Text Structures

Source of Variation	SS	df	MS	F	p
Presentation Order	10.707	1	10.707	.306	0.584673
Structure	141.835	1	141.835	4.047	0.053616*
Error	1016.260	29	35.044		

* $p \leq .05$

Table 5.3

TELEPHONE - Immediate Recall Condition
Summary of Analysis of Variance due to Presentation Order, STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL Text Structures

Source of Variation	SS	df	MS	F	p
Presentation Order	778.742	1	778.742	8.508	0.006760**
Structure	946.130	1	946.130	10.337	0.003194**
Error	2654.400	29	91.531		

** $p \leqslant .01$

Table 5.4

TELEPHONE - Delayed Recall Condition
Summary of Analysis of Variance due to Presentation Order, STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL Text Structures

Source of Variation	SS	df	MS	F	p
Presentation Order	415.297	1	415.297	7.376	0.011024**
Structure	160.295	1	160.295	2.847	0.102280
Error	1632.830	29	56.3045		

** $p \leqslant .01$

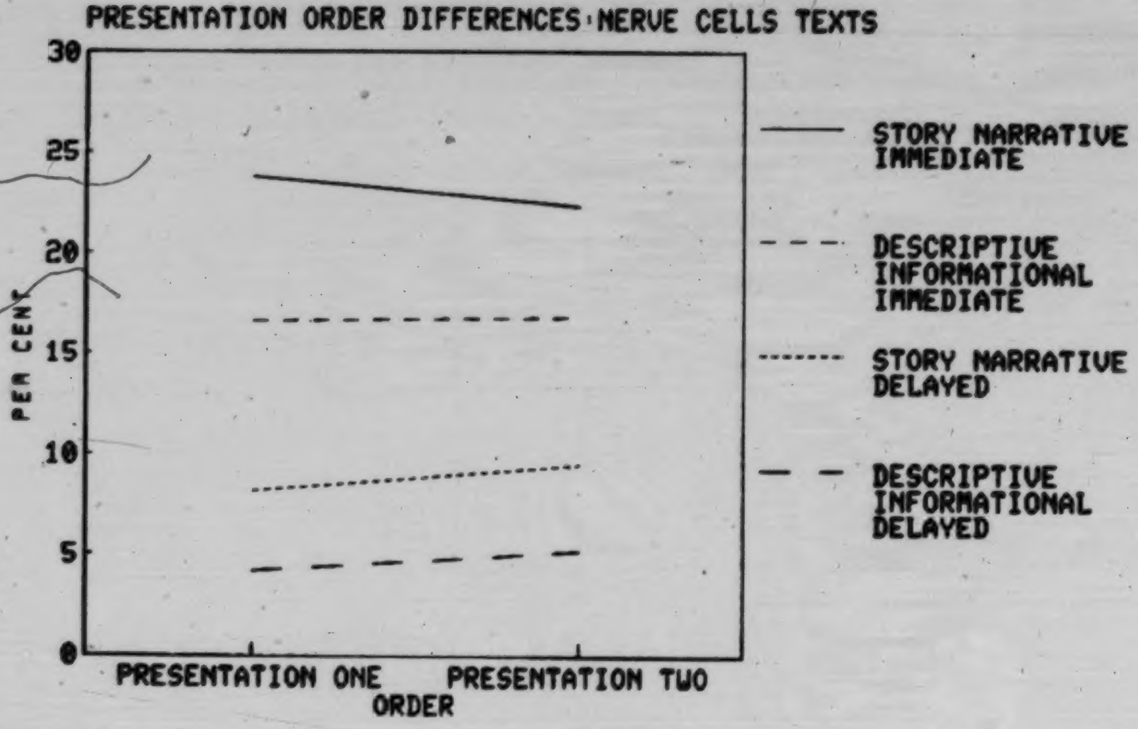


Figure 5.1

NERVE CELLS Texts
Mean Recall Proportions for (B) Presentation Order and
(A) Text Structure for the Analyses of Variance—
Immediate and Delayed Recall Conditions

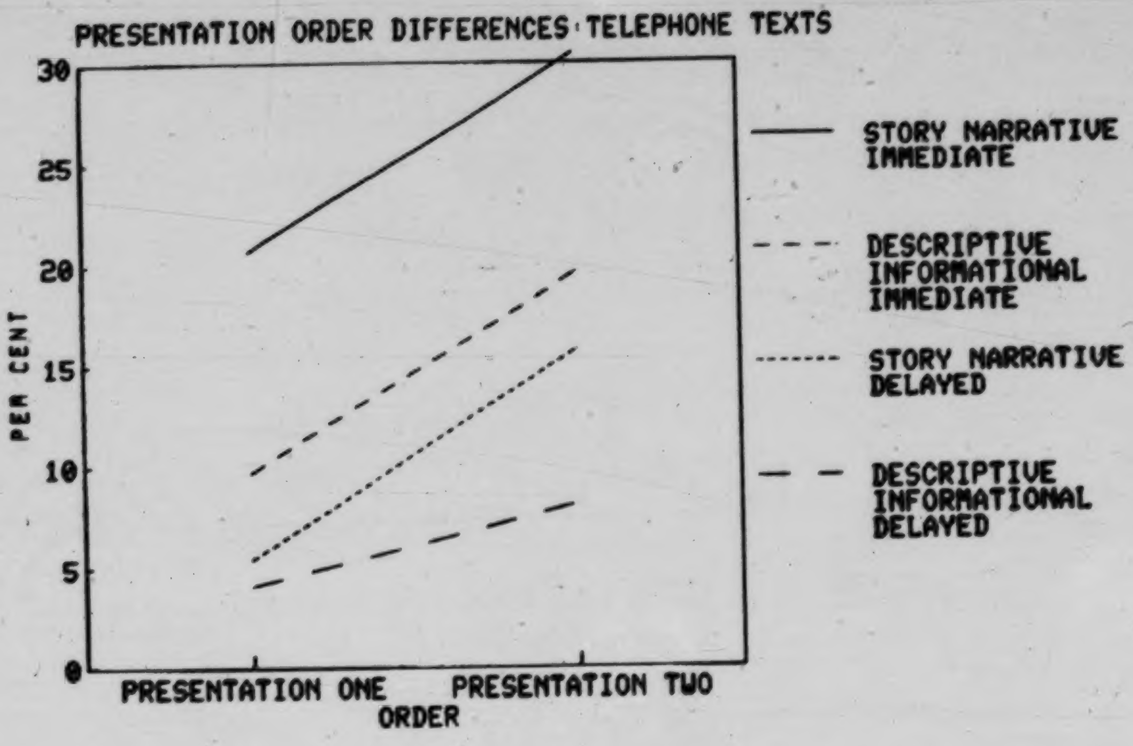


Figure 5.2

TELEPHONE Texts
Mean Recall Proportions for (B) Presentation Order and
(A) Text Structure for the Analyses of Variance—
Immediate and Delayed Recall Conditions

TELEPHONE mean recall proportions were significantly different due to presentation order, $F(1,29) = 7.376$, $p \leq .01$.

An inspection of the means in each content, structure and order position revealed an increase in recall proportions for texts which had been presented second, except for the NERVE CELLS STORY NARRATIVE text where the means were not significantly different. In both first and second presentation orders, and for both NERVE CELLS and TELEPHONE texts, mean recall proportions were greater for texts written according to a STORY NARRATIVE structure than for texts written according to a DESCRIPTIVE INFORMATIONAL structure.

Uniformity of patterns of recall across topics, structures and orders, meant that original groupings could be collapsed to compare variables within topics and between text structures. Collapsing original groupings meant that the error term for both presentation orders was included in each new group. Thus, significant differences would be more difficult to obtain. The fact that, despite this difficulty, significant differences were obtained, is evidence for the robust nature of the hypothesized text structure differences.

I. ANALYSIS 1: TEXT RECALL

Purpose

This experiment was designed to see if differences existed in the proportions of information which could be recalled from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose, both immediately and after one week. Earlier experimental work in this area has dealt mainly with simple stories. This experiment studied the effects of two prose structure types prominent in the reading materials of upper elementary students.

Design

Following the assessment of presentation order effects, the initial design was collapsed to allow study of text structure effects on recall proportions between subjects within one text content topic, and to test hypothesis 1.1.

The second design, which is modelled in Figure 5.3 was used for both NERVE CELLS and TELEPHONE content topics.

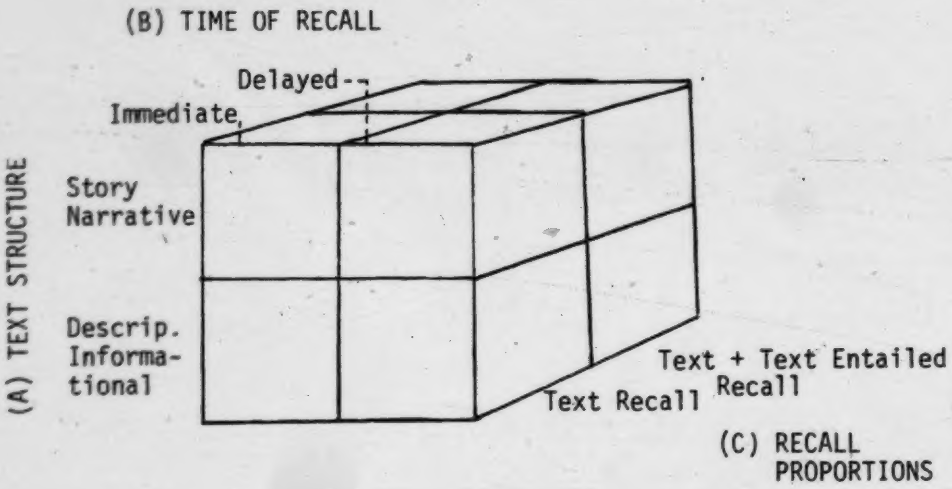

(B) TIME OF RECALL
Delayed
Immediate
(A) TEXT STRUCTURE
Story Narrative
Descrip. Informational
Text Recall
Text + Text Entailed Recall
(C) RECALL PROPORTIONS

Figure 5.3

Design for Analysis 1

Procedure

Scoring of recall protocols. Experimental texts and subjects' recall protocols of these texts were analyzed into hierarchical lists of propositions using procedures based on Kintsch's (1974) system for describing and ordering discourse. This system, described by Turner and Greene (Note 14), is summarized in Appendix A.

Recall lists of propositions were compared with template texts in two ways: text recall units, and text plus text entailed recall units. Using two types of recall categorization allowed an investigation of differences due to text structure in the proportions of information _inferred_ from text.

Results

To determine the effects on recall due to structure, two three factor analyses of variance were conducted. The three factors consisted of (A) text structure, (B) recall condition and (C) recall analysis categorization. Analyses were conducted for both NERVE CELLS and TELEPHONE content topics. Table 5.5 and 5.6 present summaries of the analysis of variance for NERVE CELLS and TELEPHONE content topics respectively; Figures 5.4 and 5.5 represent graphically the significant interactions evidenced from the analyses.

NERVE CELL Texts: Significant main effects were found in the NERVE CELLS texts due to structure $F(1,31) = 5.99$, $p \leqslant .05$; time of recall $F(1,96) = 5.28$, $p \leqslant .001$ and analysis categorizations $F(1,96) = 76.22$, $p \leqslant .001$.

Time of recall and recall analysis categorization interacted significantly $F(1,96) = 27.25$, $p \leqslant .001$. This interaction is graphed in Figure 5.4. Recall proportions in differing prose structures did not interact significantly with time of recall or recall analysis categorization.

Table 5.5

NERVE CELLS Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Recall Analysis Categorization

Source of Variation	SS	df	MS	F	p
Between subjects	3802.320	31			
A	632.477	1	632.477	5.99	0.0204990*
Subj W Group	3169.844	30	105.661		
Within subjects	8292.402	96			
B	3807.656	1	3807.656	57.28	0.0000007***
AB	51.902	1	51.902	0.78	0.3839329
B x Subj W Group	1994.266	30	66.476		
C	1505.844	1	1505.844	76.22	0.0000007***
AC	18.820	1	18.820	0.95	0.3368560
C x Subj W Group	592.680	30	19.756		
BC	151.746	1	151.746	27.25	0.0000131***
ABC	2.441	1	2.441	0.44	0.5129265
BC x Subj W Group	167.047	30	5.568		

* $p \leq .05$

*** $p \leq .001$

Table 5.6

TELEPHONE Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Recall Analysis Categorization

Source of Variation	SS	df	MS	F	p
Between subjects	4800.508	31			
A	1390.281	1	1390.281	12.23	0.0014887***
Subj W Group	3410.227	30	113.674		
Within subjects	9313.309	96			
B	2785.816	1	2785.816	32.81	0.0000038***
AB	244.059	1	244.059	2.87	0.1003743
B x Subj W Group	2547.500	30	84.917		
C	2199.727	1	2199.727	80.76	0.0000008***
AC	37.617	1	37.617	1.38	0.2491542
C x Subj W Group	817.102	30	27.237		
BC	186.641	1	186.641	11.46	0.0020005**
ABC	6.227	1	6.227	0.38	0.5410470
BC X Subj W Group	488.625	30	16.287		

** $p \leq .01$

*** $p \leq .001$

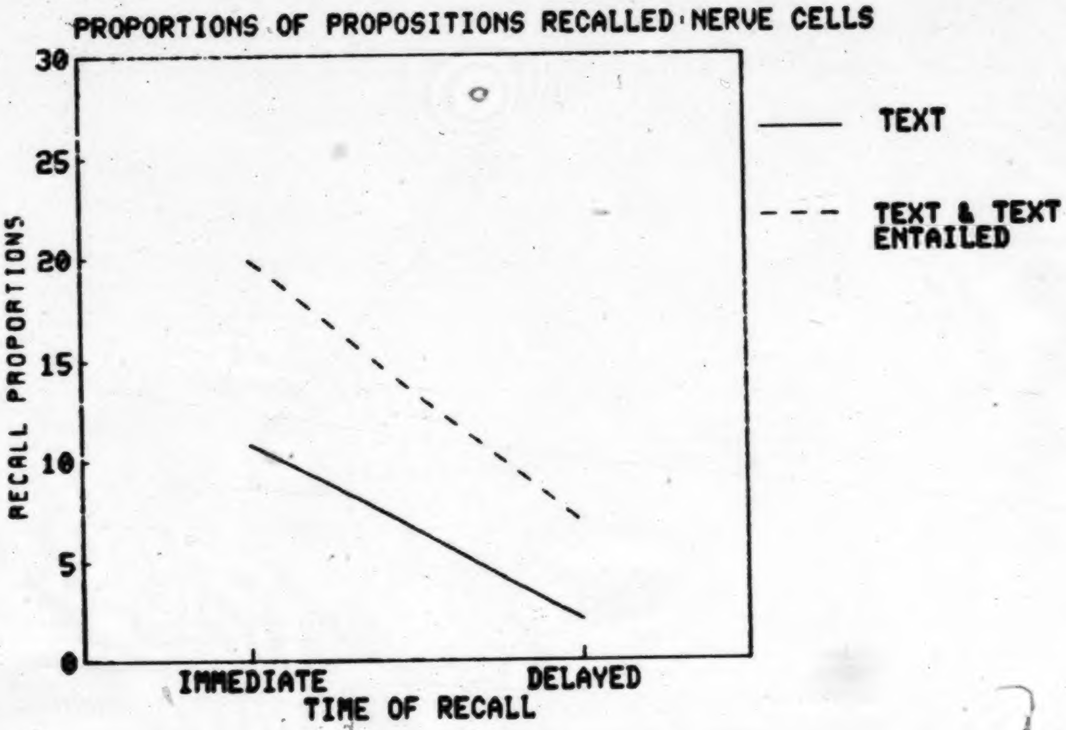


Figure 5.4

NERVE CELLS Texts
Mean Recall Proportions for (B) Time of Recall and (C) Text Analysis
Categorizations for the Analysis of Variance
($p \leqslant .001$)

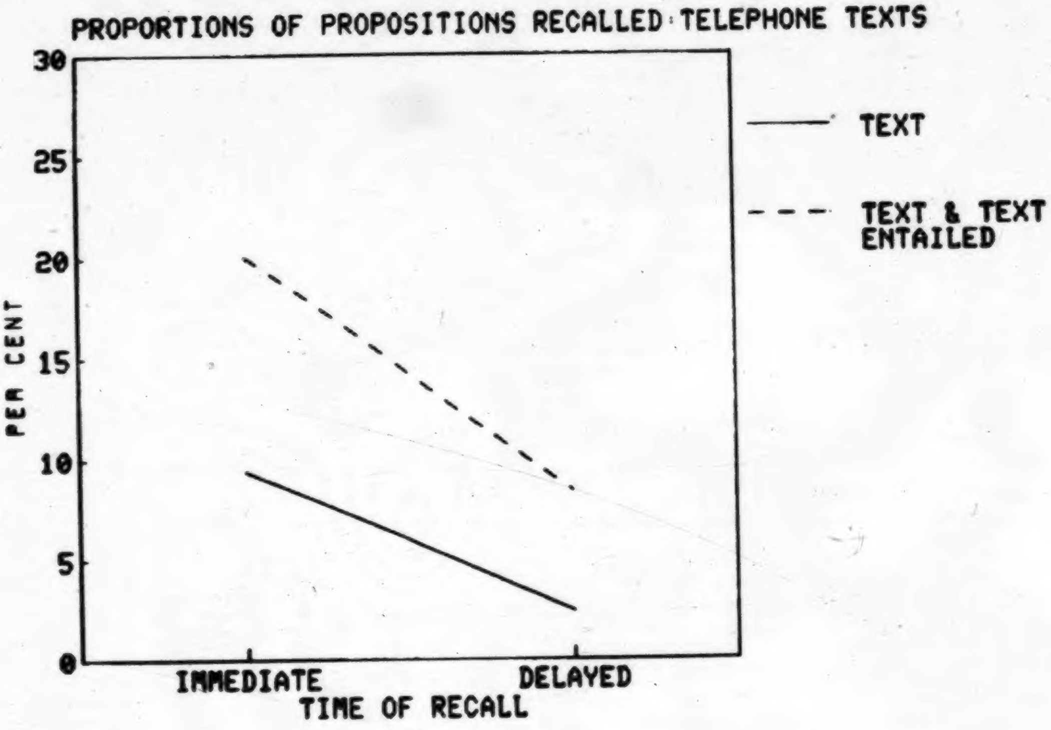


Figure 5.5

TELEPHONE Texts
Mean Recall Proportions for (B) Time of Recall and (C) Text Analysis
Categorizations for the Analysis of Variance
($p \leqslant .01$)

TELEPHONE Texts: In the TELEPHONE texts, significant main effects were found due to structure $F(1,31) = 12.23$, $p \leqslant .001$, time of recall $F(1,96) = 32.81$, $p \leqslant .001$, and recall analysis categorizations $F(1,96) = 80.76$, $p \leqslant .001$. As in the NERVE CELLS texts, time of recall and recall analysis categorizations interacted significantly, $F(1,96) = 11.46$, $p \leqslant .01$ (see Figure 5.7). There were no significant interactions between differing text structures and time of recall, or differing text structures and recall analysis categorizations.

Discussion

In both NERVE CELLS and TELEPHONE texts, STORY NARRATIVE recall proportions were found to be significantly higher than those of DESCRIPTIVE INFORMATIONAL recall. When content is controlled, and texts differ by structure, the proportion of information recalled from STORY NARRATIVE text was significantly greater than that recalled from DESCRIPTIVE INFORMATIONAL text.

A sharp decline in both text and text plus entailed recall proportions was noted in the delayed recall position. Proportionately more text information was recalled immediately in both structures in the two content topics than was recalled in the delayed condition. The decline in the proportion of text plus text entailed recall in the delayed recall position, was even sharper than the decline in the proportion of text recall in the delayed recall position. Sixth grade proficient readers inferred more information when recalling text immediately than when recalling text after a delay of one week.

The fact that text plus text entailed recall proportions were comprised of exact or synonymous template text propositions *plus* information entailed by text, is the reason that text plus text entailed recall was significantly higher than text recall in both immediate and delayed recall conditions, and for both STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text structures.

The similarities between the recall behaviors of subjects over two content topics suggests the importance of the text structure variable when information is recalled from differing text structures where the content is relatively unfamiliar.

II. ANALYSIS 2: CATEGORIES OF RECALL

Purpose

When a subject is asked to recall a text, the subject's total response can be sectioned according to specific categories which vary in their relationship to the template text. In the light of non-significant recall differences due to text structure (Analysis 1), this analysis investigated recall categories within the responses of subjects who had read different text structures.

Design

A 2 x 2 x 4 between subjects design was developed, with two levels of factor A: (STRUCTURE: STORY NARRATIVE, DESCRIPTIVE INFORMATIONAL); two levels of factor B: (TIME OF RECALL: immediate, delayed), and four levels of factor C: (CATEGORIES OF RECALL: text, text entailed, text evoked, text external). This design which guided statistical analysis is shown in Figure 5.6. The design was used for both NERVE CELLS and TELEPHONE text recalls.

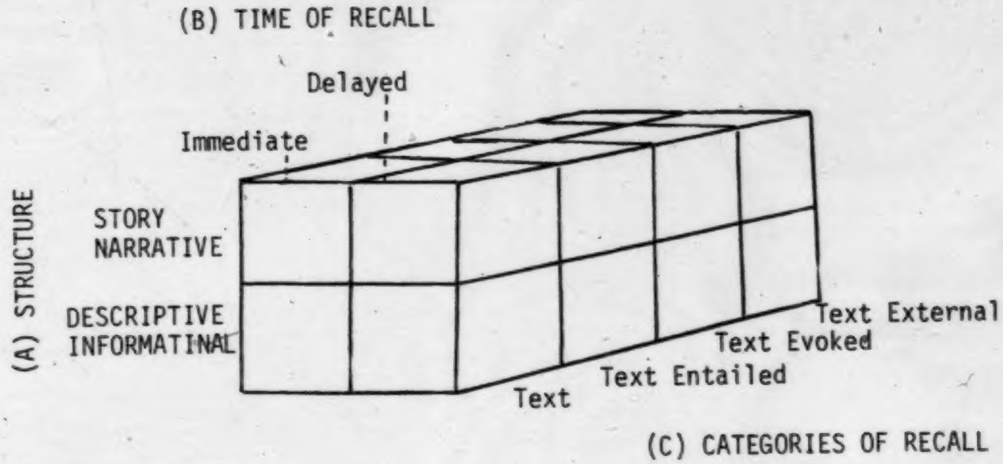

(B) TIME OF RECALL
Delayed
Immediate
(A) STRUCTURE
STORY NARRATIVE
DESCRIPTIVE INFORMATINAL
Text External
Text Evoked
Text Entailed
Text
(C) CATEGORIES OF RECALL

Figure 5.6

Design for Analysis 2

Procedure

Scoring of children's recall protocols. Original stimulus passages and subjects' recall protocols of these passages were analyzed into hierarchies of propositions using procedures based on Kintsch's (1974) system for describing and ordering discourse (Turner & Greene, Note 14). (See Appendix A.) Propositions were then categorized according to a system modelled after Drum and Lantaff's (Note 7) category system for scoring recall protocols as they compare with stimulus passages. The categories used for this system are detailed below and summarized in Table 5.7.

Table 5.7

Category System for Scoring Recall Protocols as They Compare with Template Text

A. TEXT SPECIFIC INFORMATION

A1	Verbatim recall of text propositions
A2	Synonymy of elements in text propositions
A3	Substitution of pronouns
A4	Propositional contractions

B. TEXT ENTAILED INFORMATION

B1	Inferences entailed by the text
B2	Case-related information
B3	Local summary
B4	Predicate expansion of text propositional units
B5	Argument/Attribute expansion of text propositional units

C. TEXT EVOKED INFORMATION

C1	Faulty inference
C2	Erroneous expansion of text propositional units
C3	Unacceptable substitutions for text propositional units and errors
C4	Experiential intrusions
C5	Generalizations with no specific relationship to text propositional units

D. TEXT EXTERNAL INFORMATION

D1	Story telling conventions
D2	Repetitions of previous statements in recall
D3	False starts; statements which appear to be left hanging

These categories will be defined and then explained further by means of examples from the transcripts collected for the study:

A. Text Specific Information — Protocol propositional units which are text specific are the same, or synonymous with text propositional units.

A1 Verbatim recall of text propositions.

A2 Synonymy of elements in text propositions:

Text: All sounds are caused by vibrations.

Protocol: "Sound is made of vibrations." (Subject 6)
TELEPHONE DESCRIPTIVE INFORMATIONAL passage.

A3 Substitution of pronouns if the referent is present elsewhere in recall.

A4 Propositional contractions:

Text: A nerve cell is very tiny and a microscope is needed to study it.

Protocol: "Nerve cells are microscopic." (Subject 15)
NERVE CELLS DESCRIPTIVE INFORMATIONAL passage.

B. Text Entailed Information — Protocol propositional units which summarize information from two or more text propositions, put together text specific information in new ways, or add text related information that is semantically entailed by the text (i.e., text connecting inferences).

B1 Inferences entailed by the text:

Text: Bell's first telephone words were a cry of help. He had spilled acid over his clothes.

Protocol: "The first thing he said into the telephone was a cry for help because he had spilled acid all over his clothes." (Subject 4) TELEPHONE STORY NARRATIVE passage.

B2 Case related information involves the inclusion of reasonable information in terms of the context of the stimulus passage. A content expert may be required to judge the adequacy of such prior information as represented in a recall protocol.

Text: He [Alexander Graham Bell] experimented with electricity. In 1876, he found a way to carry the voice using electricity.

Protocol: "He was working with voice like he was tryin' to transmit voices for like deaf people." (Subject 29) TELEPHONE STORY NARRATIVE passage.

B3 Local summary — Protocol propositional units which summarize text propositional units.

Text: Alexander Graham Bell was a professor at Boston University. He experimented with electricity. In 1876, he found a way to carry the voice using electricity.

Protocol: "Alexander Graham Bell worked at Boston University and he made the telephone." (Subject 13) TELEPHONE STORY NARRATIVE passage.

B4 Predicate expansion of text propositional units.

Text: Golgi found they don't really join at all. They leave tiny gaps called synapses.

Protocol: "He looked at them and he saw that they left little gaps . . ." (Subject 30) NERVE CELLS STORY NARRATIVE passage.

B5 Argument/Attribute expansion of text propositional units

Text: A nerve cell is very tiny and a microscope is needed to study it.

Protocol: "A nerve cell is a tiny thing . . . you can't see it with the human eye you have to have a microscope. (Subject 29) NERVE CELLS DESCRIPTIVE INFORMATIONAL passage.

C Text Evoked Information — Protocol propositional units which are peripheral to text propositional units, generalizations without specific text relationships and erroneous responses.

C1 Faulty inference.

Text: In 1873, Golgi found a way of staining nerve cells with silver salts. Then he could study them with a microscope. He could see details of the nerve cell that others had not seen before.

Protocol: "He looked under this microscope that no one's ever seen." (Pilot study data) NERVE CELLS STORY NARRATIVE passage.

C2 Erroneous expansion of text propositional units.

Text: Until silver salts were used to stain nerve cells, there was no way of knowing what a nerve cell looked like. Now doctors know that the branches in different nerve cells don't really join at all.

Protocol: ". . . they use the salt and they find that the nerve cells are not connected by these things and with this salt by studying these nerve cells they can find um the difference in the nerve cells when people are under stress . . ." (Subject 15) NERVE CELLS DESCRIPTIVE INFORMATIONAL passage.

C3 Unacceptable substitutions of text propositional units and errors.

Text: A telephone transmitter is a thin sheet of metal.

Protocol: "Electricity has a transmitter that is a thin sheet of metal." (Subject 1) TELEPHONE DESCRIPTIVE INFORMATIONAL passage.

C4 Experiential intrusions.

Text: The metal sheet bends and makes another copy of voice sounds. The person you are talking to hears this copy of the sounds of your voice.

Protocol: "The sounds that you hear right now are actually vibrations coming from me." (Subject 1) TELEPHONE DESCRIPTIVE INFORMATIONAL passage.

C5 Generalizations with no specific relationship to text propositional units.

Protocol: "it was about the medicine 'n stuff." (Subject 20, Delayed Recall) NERVE CELLS DESCRIPTIVE INFORMATIONAL passage.

C6 Arguments from text propositional units recalled without predicates or with predicates that are related to story telling conventions.

Protocol: "the other one was about cells." (Subject 31, Delayed Recall) NERVE CELLS DESCRIPTIVE INFORMATIONAL passage.

Text: As it bends back, the metal pushes against a box full of carbon grains. This makes the carbon wiggle.

Protocol: ". . . the metal . . . the carbon it . . . the bends." (Subject 8) TELEPHONE DESCRIPTIVE INFORMATIONAL passage.

D Text External Information — Protocol information which has no relationship to text propositional units, is a repetition of previously recalled statements, or a false start.

D1 Story telling conventions which relate to the experimental situation.

Text: They leave tiny gaps called synapses.

Protocol: "The are separated by little spaces called some technical name I don't remember." (Subject 19) NERVE CELLS DESCRIPTIVE INFORMATIONAL passage.

Protocol: "Well in 8 . . . um 1890 something I can't remember the date this guy did . . . things about nerve cells." (Subject 25, Delayed Recall) NERVE CELLS STORY NARRATIVE passage.

D2 Repetitions of previous statements in recall.

Protocol: "And at the end of the paragraph he finds out that they don't really join together something like that, some sort of nerves don't join together." (Subject 28) NERVE CELLS STORY NARRATIVE passage.

D3 False starts, statements which appear to be left hanging.

Protocol: ". . . the transmit ah the part you speak into in a telephone it's really a piece of sheet metal which vibrates when you speak into it it vibrates against a bunch 'a grains and then it goes the vibrations through the wire . . ." (Subject 27) TELEPHONE DESCRIPTIVE INFORMATIONAL passage.

Results

To study the proportions of response within each recall category, when template text structures differ and to test Hypothesis 1.2, two three way analyses of variance were conducted. The three factors consisted of (A) text structure, (B) recall condition and (C) categories of recall. Analyses were conducted for both NERVE CELLS and TELEPHONE content topics. Tables 5.8 and 5.9 present summaries of the analysis of variance for NERVE CELLS and TELEPHONE content topics respectively; Figure 5.7 graphically represents the significant interaction evidenced from the analysis.

NERVE CELL texts: A significant main effect due to recall categories resulted, $F(3,224) = 6.00$, $p \leq .001$.

Proportions of propositions recalled in specific recall categories, as outlined above, differed significantly according to recall condition, $F(3,224) = 10.10$, $p \leq .001$. (See Figure 5.7.)

There were no significant differences between recalls of information in differing text structures when categories of recall were considered, or in differing recall conditions.

TELEPHONE texts: A significant main effect due to recall categories was noted, $F(3,224) = 12.77$, $p \leq .001$. As in the NERVE CELLS texts, there were no significant recall category differences due to structure. In addition, in TELEPHONE texts, there were no significant differences between proportions of propositions within recall categories.

Table 5.8

NERVE CELLS Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Categories of Recall

Sources of Variation	SS	df	MS	F	p
Between subjects	3458.125	31			
A	86.000	1	86.000	0.77	0.3886890
Subj W Group	3372.125	30	112.404		
Within subjects	79529.188	224			
B	288.250	1	288.250	2.41	0.1312394
AB	25.563	1	25.563	0.21	0.6473670
B x Subj W Group	3591.813	30	119.727		
C	6560.875	3	2186.958	6.00	0.0008928***
AC	3681.000	3	1227.000	3.37	0.8219810
C x Subj W Group	32779.250	90	364.214		
BC	8019.375	3	2673.125	10.10	0.0000104***
ABC	755.875	3	251.958	0.95	0.4191978
BC x Subj W Group	23827.188	90	264.746		

*** $p \leqslant .001$

Table 5.9

TELEPHONE Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Categories of Recall

Source of Variation	SS	df	MS	F	p
Between subjects	1469.625	31			
A	124.625	1	124.625	2.78	0.1058712
Subj W Group	1345.000	30	44.833		
Within subjects	96667.813	224			
B	124.750	1	124.750	2.78	0.1056209
AB	124.688	1	124.688	2.78	0.1057038
B x Subj W Group	1344.313	30	44.810		
C	15994.375	3	5331.457	12.77	0.0000018***
AC	2205.313	3	735.104	1.76	0.1604941
C x Subj W Group	37589.188	90	417.657		
BC	2902.188	3	967.396	2.45	0.0687293
ABC	833.438	3	277.813	0.70	0.5524877
BC x Subj W Group	35549.563	90	394.995		

*** $p \leq .001$

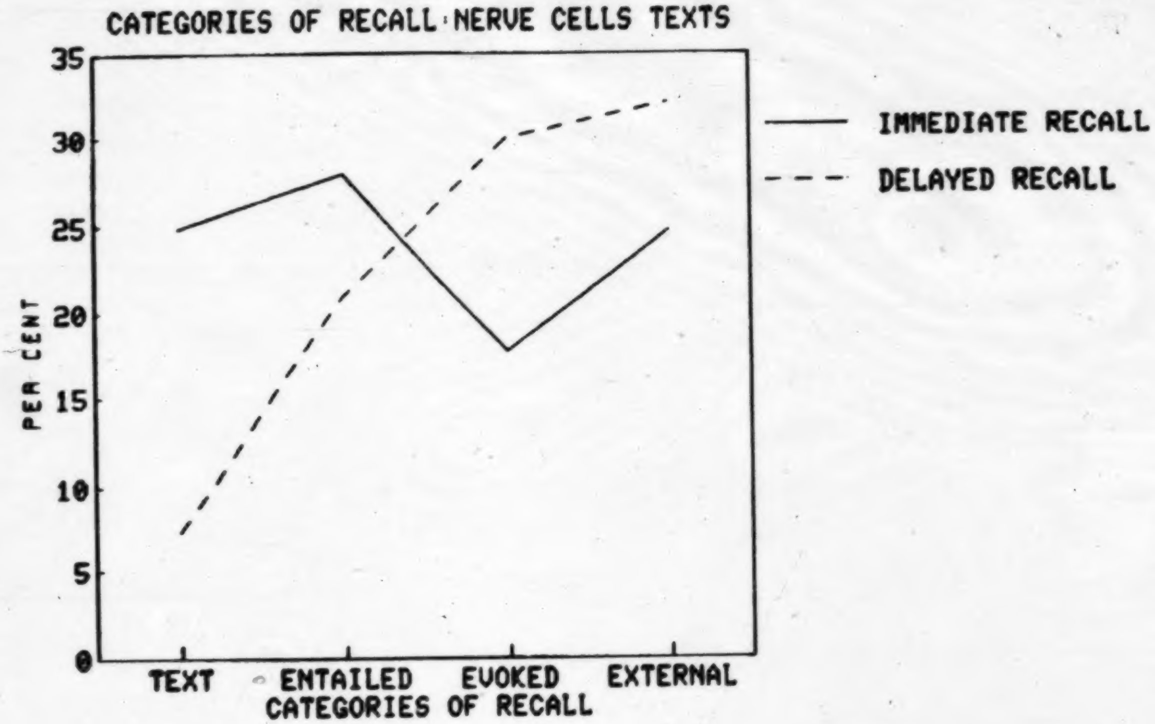


Figure 5.7

NERVE CELLS Texts
Mean Recall Proportions for (B) Time of Recall and (C) Text
Recall Categories for the Analysis of Variance
($p \leq .001$)

Discussion

Meyer, Brandt and Bluth's (Note 6) study of ninth graders' identification and utilization of text structures found that for most high comprehenders, use of the author's text structure for organization of recall was evident. The absence of significant category difference due to structure for the sample of sixth grade proficient readers utilized for this study, suggests that text structure does not affect the proportionate amount of recall within each category. In other words, sixth grade proficient readers tend to recall relatively similar proportions of text specific propositional units, text entailed propositional units, text evoked propositional units and text external propositional units.

Drum's study of the recall patterns of readers found that able readers recalled more text and text entailed information and were able to recall information from all parts of a passage. Less able readers either stated a text proposition and then repeated it, or they stated an idea and elaborated on it without reference to the template text (Drum, Note 15).

An examination of mean scores (see Table 5.10) pointed out results which differed from Drum's. All the subjects for this study were proficient readers. In both STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text recalls, for both content topics, subjects recalled more text evoked and text external information than text and text entailed information. The behaviors described by Drum as representative of less able readers, were often present in the recall protocols of these proficient readers.

Table 5.10

Mean Scores: Categories of Recall:
NERVE CELLS, TELEPHONE Texts

	Text	Text Entailed	Text Evoked	Text External
NERVE CELLS Texts:				
STORY NARRATIVE	20.774	25.129	18.307	32.809
DESCRIPTIVE INFORMATIONAL	11.403	23.801	29.322	27.855
TELEPHONE Texts:				
STORY NARRATIVE	15.102	27.689	28.689	28.519
DESCRIPTIVE INFORMATIONAL	7.448	24.901	25.256	36.771

The main difference between Drum's study and this study was the age and experience of the subjects involved. Whereas Drum's subjects were at Grade 8, the subjects involved in this study were at Grade 6. Several more years experience with DESCRIPTIVE INFORMATIONAL prose and with reading tasks in general also separates the two groups of subjects.

Taking these factors into account, it seems reasonable to suggest that sixth grade proficient readers are more prone to making generalizations with no specific relationships to template text propositional units and to making erroneous responses than are eighth grade proficient readers. The decline in importance of prior knowledge for older children (Pace, Note 10) and adult readers (Lewis, Note 11) is also of note here. Older subjects seem to be more aware of the information which is text information as opposed to generalized knowledge about the topic of the text. Although proficient reading is enhanced by background experiences about the topic of a text, experimental tasks which require recall of a text which has been read, also require the subject to differentiate between the two information sources. Whereas this differentiation ability separated Drum's able and less able eighth grade readers, it remained undifferentiated for the proficient sixth graders who were involved in this study.

No significant recall category proportions due to differences in text structure were evident. For proficient sixth grade readers, the structure of the text does not affect the proportions of recall in each recall category. An inspection of the mean scores did evidence differences for the text recall category between text structures. This result had already been verified in Analysis 1.

III. ANALYSIS 3: TYPES OF PROPOSITIONS IN RECALL

Purpose

Kintsch's analysis of the ideas contained in discourse specifies three types of propositions: predicate propositions, modifier propositions and connective propositions. One of the initial text analyses reported in Chapter 4 indicated the proportions of these proposition types which were found in experimental texts (Figure 4.1). One of the research questions which guided this study questioned the effect of text structure on the recall proportions of specific types of propositions. In other words are predicate propositions which have a verb base recalled better than modifier propositions which qualify predicate propositions in different ways or than connective propositions which join propositions together when a STORY NARRATIVE structure if used to convey information, as opposed to a DESCRIPTIVE INFORMATIONAL text structure?

Design

A 2 x 2 x 3 between subject design was used. This design contained two levels of factor A: (STRUCTURE: STORY NARRATIVE, DESCRIPTIVE INFORMATIONAL), two levels of factor B: (TIME OF RECALL: immediate, delayed) and three levels of factor C: (TYPES OF PROPOSITIONS: predicate, modifier, connective). The design is illustrated in Figure 5.8

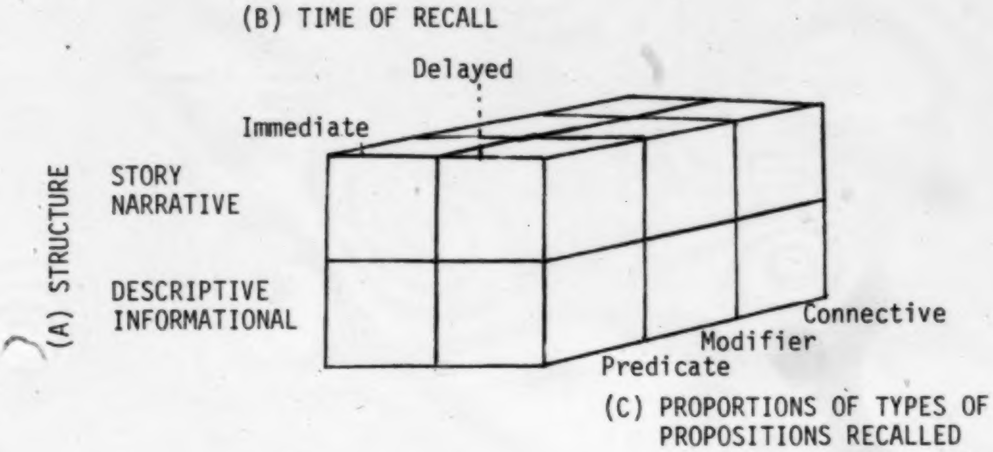

(B) TIME OF RECALL
Delayed
Immediate
(A) STRUCTURE
STORY NARRATIVE
DESCRIPTIVE INFORMATIONAL
Connective
Modifier
Predicate
(C) PROPORTIONS OF TYPES OF PROPOSITIONS RECALLED

Figure 5.8

Design for Analysis 3

Procedure

Text recall protocols were initially analyzed as described in Analysis 1. Following this, each recall propositional unit was compared with the template text propositional unit counterpart, from which it had been derived. Each recall propositional unit was assigned a propositional type label, which was the same as the propositional type of the counterpart proposition in the template text base. For the purposes of this analysis, text recall and text entailed recall categories were utilized. Because text evoked and text external categories of recall propositions were so far removed from template text propositions so that comparisons were not possible, they were excluded.

Proportions of propositional units recalled in each propositional type category were calculated as a fraction of total proportions of each propositional type found in template texts (Figure 4.1). These data were used to study the effect of text structure on the recall of specific types of text propositions.

Results

Two three way analyses of variance were conducted to test Hypothesis 1.3. The three factors consisted of (A) text structure, (B) time of recall and (C) types of propositions. Analyses were conducted for both NERVE CELLS and TELEPHONE content topics. Table 5.11 and 5.12 summarize the analysis of variance for NERVE CELLS and TELEPHONE content topics, respectively. Figures 5.9, 5.10 and 5.11 graph the significant interactions evidenced from the analysis.

The Newman-Keuls method was used to compare the means of proposition types, after three way analyses of variance had evidenced significant effects. Table 5.13 summarizes information for the two content topics which was found as a result of this procedure (Winer, 1971:217).

NERVE CELL Texts: Significant main effects were found for all three factors in the NERVE CELLS texts: structure $\underline{F}(1,31) = 5.17$, $\underline{p} \leq .05$, time of recall $\underline{F}(1,160) = 62.51$, $\underline{p} \leq .001$, and types of propositions recalled $\underline{F}(2,160) = 16.62$, $\underline{p} \leq .001$.

Proportions of types of propositions recalled from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text structures differed significantly, $\underline{F}(2,160) = 9.87$, $\underline{p} \leq .001$. This interaction is graphed in Figure 5.9.

Proportions of types of propositions recalled in differing recall conditions (immediate, delayed) differed according to text structure, $\underline{F}(2,160) = 7.33$, $\underline{p} \leq .001$. This interaction is shown in Figure 5.10.

Table 5.11

NERVE CELLS Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Types of Propositions Recalled

Source of Variance	SS	df	SS	F	p
Between subjects	8112.773	31			
A	1192.328	1	1192.328	5.17	0.0303212*
Subj W Group	6920.445	30	230.682		
Within subjects	21172.133	160			
B	7815.816	1	7815.816	62.51	0.0000007***
AB	79.734	1	79.734	0.64	0.4308373
B x Subj W Group	3751.285	30	125.043		
C	2016.719	2	1008.359	16.62	0.0000019***
AC	1197.844	2	598.922	9.87	0.0001982***
C x Subj W Group	3641.148	60	60.686		
BC	165.293	2	82.646	2.46	0.0936659
ABC	491.895	2	245.947	7.33	0.0014179***
BC x Subj W Group	2012.496	60	33.542		

* $p \leqslant .05$

*** $p \leqslant .001$

Table 5.12

TELEPHONE Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Types of Propositions Recalled

Source of Variance	SS	df	MS	F	p
Between subjects	13645.863	31			
A	4734.574	1	4734.574	15.94	0.0003912***
Subj W Group	8911.289	30	297.043		
Within subjects	28510.836	160			
B	7757.344	1	7757.344	34.62	0.0000027***
AB	886.133	1	886.133	3.95	0.0559409
B x Subj W Group	6722.672	30	224.089		
C	3333.980	2	1666.990	23.50	0.0000001***
AC	1583.707	2	791.854	11.16	0.0000765***
C x Subj W Group	4257.023	60	70.950		
BC	135.219	2	67.609	1.14	0.3261533
ABC	281.313	2	140.656	2.37	0.1017114
BC x Subj W Group	3553.516	60	59.225		

*** $p < .001$

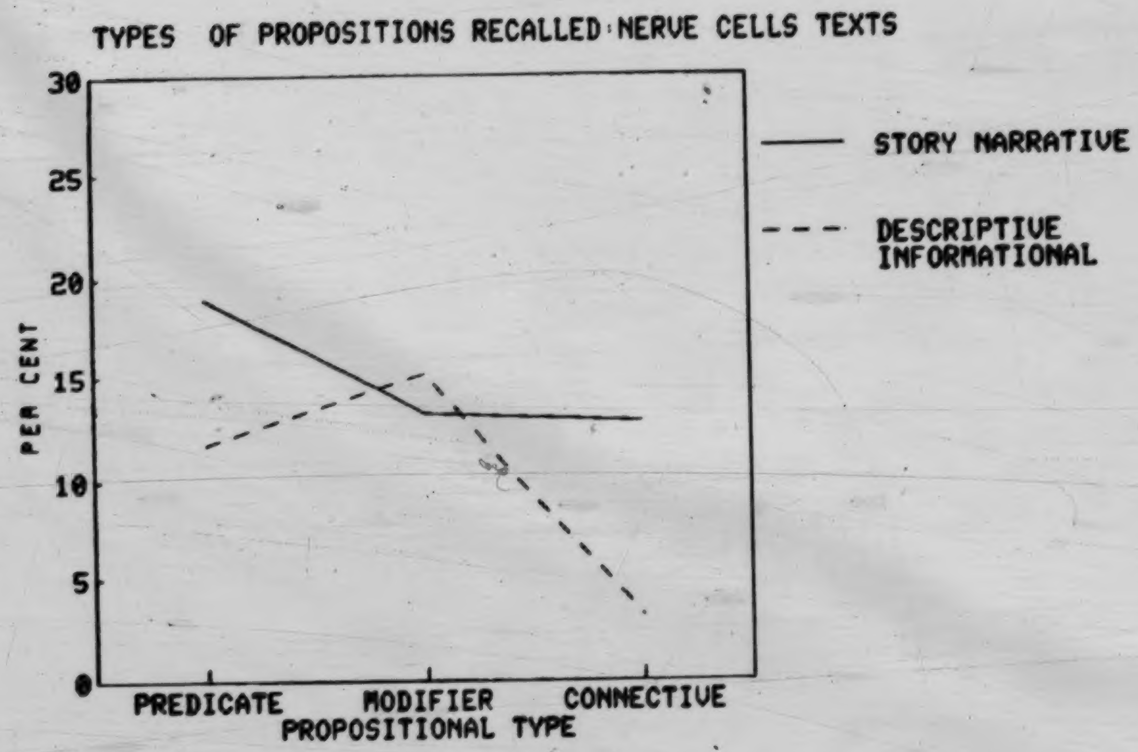


Figure 5.9

NERVE CELLS Texts
Mean Recall Proportions for (A) Text Structure and
(C) Types of Propositions Recalled for the
Analysis of Variance
($p \leq .001$)

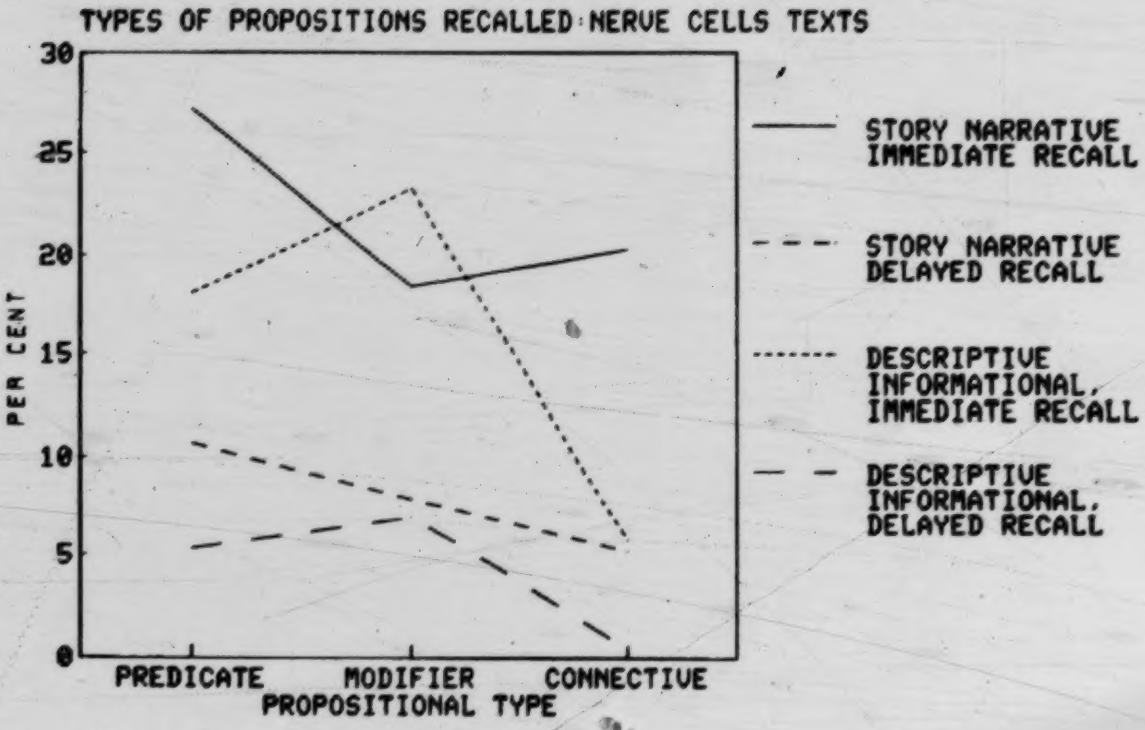


Figure 5.10

NERVE CELLS Texts
Mean Recall Proportions for (A) Text Structure, (B) Time of Recall and (C) Types of Propositions Recalled for the Analysis of Variance
$(p < .001)$

Table 5.13

Summary of Posthoc Comparisons of Means Newman-Keuls Method for Types of Propositions—NERVE CELLS, TELEPHONE Texts

NERVE CELLS		TELEPHONE	
Comparison	Significance Level	Comparison	Significance Level
STORY NARRATIVE - Immediate		STORY NARRATIVE - Immediate	
(P) 27.232 - (M) 18.422	**	(M) 36.109 - (C) 17.411	**
(P) 27.232 - (C) 20.312	*	(P) 29.077 - (C) 17.411	**
(C) 20.312 - (M) 18.422		(M) 36.109 - (P) 29.077	
STORY NARRATIVE - Delayed		STORY NARRATIVE - Delayed	
(P) 10.715 - (C) 5.208	*	(M) 13.887 - (C) 4.910	**
(M) 7.895 - (C) 5.208		(P) 12.771 - (C) 4.910	**
(P) 10.715 - (M) 7.895		(M) 13.887 - (C) 12.771	
DESCRIPTIVE INFORMATIONAL - Immediate		DESCRIPTIVE INFORMATIONAL - Immediate	
(M) 23.264 - (C) 5.802	**	(P) 19.837 - (C) 9.658	**
(P) 18.081 - (C) 5.802	**	(P) 19.837 - (M) 10.416	*
(M) 23.264 - (P) 18.081		(M) 10.416 - (C) 9.658	
DESCRIPTIVE INFORMATIONAL - Delayed		DESCRIPTIVE INFORMATIONAL - Delayed	
(M) 6.946 - (C) 0.446	**	(P) 10.055 - (C) 1.136	**
(P) 5.341 - (C) 0.446	**	(P) 10.055 - (M) 3.472	*
(M) 6.946 - (P) 5.341		(M) 3.472 - (C) 1.136	

(P) - Predicate Propositions Recalled
(M) - Modifier Propositions Recalled
(C) - Connective Propositions Recalled

* $p \leq .05$
** $p < .01$

TELEPHONE Texts: For TELEPHONE texts, significant main effects due to structure $F(1,31) = 15.94$, $p \leqslant .001$; time of recall $F(1,160) = 34.62$, $p \leqslant .001$; and types of propositions recalled $F(2,160) = 23.50$, $p \leqslant .001$ were found.

Proportions of types of propositions recalled from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text structures differed significantly, $F(2,160) = 11.16$, $p \leqslant .001$. The mean score of Modifier propositions recalled from the STORY NARRATIVE text ($\overline{X} = 24.998$) was extremely high when compared with the mean score of Modifier propositions recalled from the DESCRIPTIVE INFORMATIONAL text ($\overline{X} = 6.994$). Figure 5.11 shows these and other differences.

There were no significant differences between proportions of types of propositions recalled in differing recall conditions (immediate, delayed) and in differing text structures (STORY NARRATIVE, DESCRIPTIVE INFORMATIONAL) for TELEPHONE texts.

Discussion

"Propositions are representations of conceptual units" (Turner & Greene, Note 14, p. 7). Predicate propositions are often verbs, expressing an action or a state. Modifier propositions express different forms of restrictions of one concept by another. There are four main types of modifier relations: Qualifiers, Partitives, Quantifiers and Negations. Connective propositions relate propositions in the text to one another. Connective propositions coordinate text and make it coherent. There are eight main types of connective propositions: conjunction, disjunction, causality, purpose, concession, contrast, condition and circumstance. Texts are comprised of a series

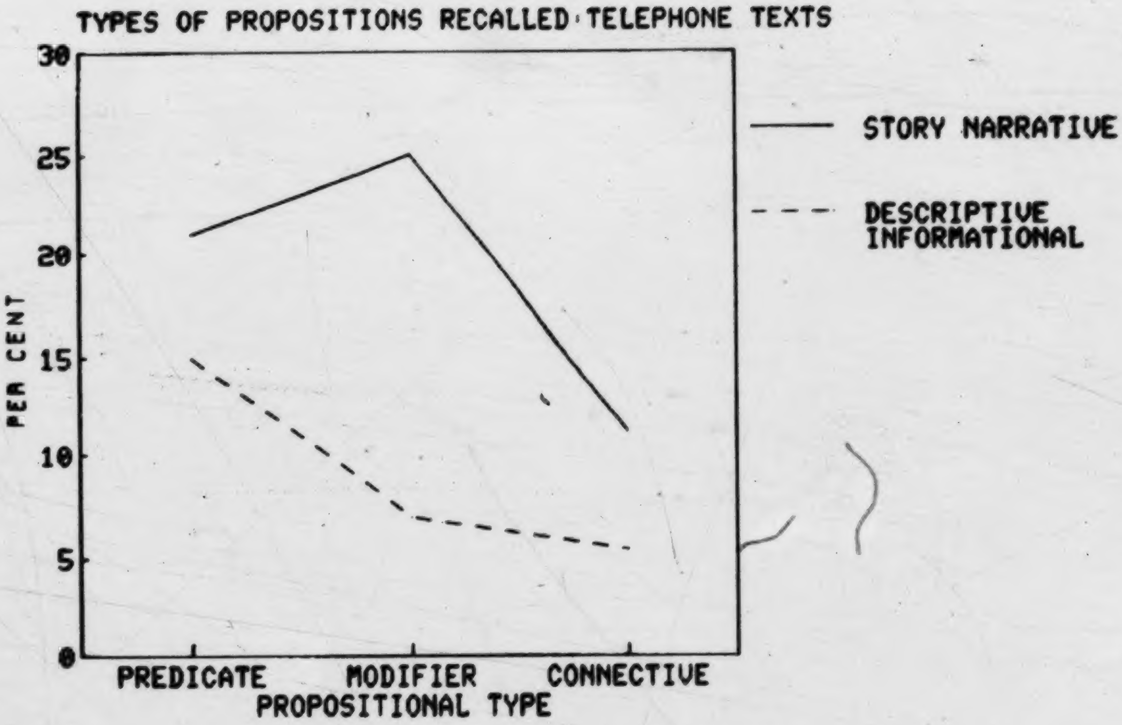


Figure 5.11

TELEPHONE Texts
Mean Recall Proportions for (A) Text Structure and
(C) Types of Propositions Recalled for
the Analysis of Variance
($p < .001$)

of propositions. The texts which were developed for this study showed similarity in terms of frequency of occurrence of propositional types represented across experimental template texts. However, recall of specific types of propositions differed according to the structure of the passage in question.

In the NERVE CELLS texts, predicate propositions were recalled more frequently from the STORY NARRATIVE texts than from the DESCRIPTIVE INFORMATIONAL texts. This would suggest that the actions or states described within the STORY NARRATIVE structure are better linked so as to be recalled or inferred more easily. These results mirror results from a similar study conducted by Gomulicki (1956), who examined recall protocols from 37 prose passages, two of which were descriptive and the rest, narrative. Gomulicki found that descriptive, modifying segments of prose were poorly recalled in longer passages, while "agent-action-effect" units were recalled best.

Modifier propositions were better recalled from the NERVE CELLS DESCRIPTIVE INFORMATIONAL text suggesting that DESCRIPTIVE INFORMATIONAL texts may be more conducive to recall and inference of the various kinds of restrictions which qualify predicate propositions. However this recall behavior was not evident within TELEPHONE texts, perhaps because of subjects' relative familiarity with the content topic of the TELEPHONE texts.

Proportions of connective propositions recalled in STORY NARRATIVE texts were significantly higher than those recalled in DESCRIPTIVE INFORMATIONAL texts for both TELEPHONE and NERVE CELLS content topics. Children appear to be able to view the connecting, linking ideas as they function within STORY NARRATIVE texts and to retrieve them within a coherent recall utterance. DESCRIPTIVE INFORMATIONAL text coherence features, in the form of connective propositions, do not have as important a function within DESCRIPTIVE INFORMATIONAL texts as coherence features in STORY NARRATIVE texts. This decreased emphasis within DESCRIPTIVE INFORMATIONAL texts is evidenced in the decreased recall across both content topics for connective propositions.

An analysis procedure may have lowered the recall proportions of connective propositions counted. Many subjects used connective propositions such as "and" and "and then" to join lists of facts recalled from prose. These did not necessarily make the facts interdependent but served as a story-telling convention used by subjects in many instances to make disjointed recall cohesive. This left the researcher with some difficult judgements: deciding which propositions were connective propositions, and which were simple story-telling devices and, hence, attributable to the external recall category.

IV. ANALYSIS 4: HIERARCHICAL LEVELS OF INFORMATION IN RECALL

Purpose

Studies by Meyer (1975), Kintsch et al. (1975), McKoon (1977) and DeFratis Evans (1977) have indicated that "important" elements within a text are the ones that tie together the most information. These ideas have been termed superordinate or high level propositions, and have shown to be frequently better recalled than subordinate or low level propositions. Most studies which have studied this phenomenon have used simple stories as stimulus passages. The purpose of this experiment was to see if differences in text structure, i.e., STORY NARRATIVE, DESCRIPTIVE INFORMATIONAL prose, would significantly affect recall of propositions at specific levels in the text hierarchy of propositions, viz. high, medium and low.

Design

Subjects were assigned to a 2 x 2 x 3 between subjects design with two levels of factor A (STRUCTURE: STORY NARRATIVE, DESCRIPTIVE INFORMATIONAL), two levels of factor B (TIME OF RECALL: immediate, delayed) and three levels of factor C (HIERARCHICAL LEVELS OF INFORMATION: high, medium, low). The design is shown in Figure 5.12 and was used for both NERVE CELLS and TELEPHONE topics.

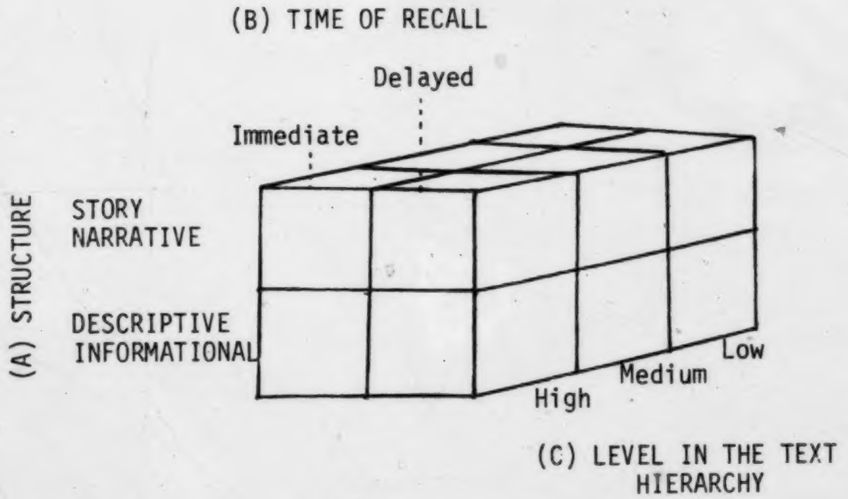

(B) TIME OF RECALL
Delayed
Immediate
(A) STRUCTURE
STORY NARRATIVE
DESCRIPTIVE INFORMATIONAL
High
Medium
Low
(C) LEVEL IN THE TEXT HIERARCHY

Figure 5.12

Design for Analysis 4

Procedure

After analysis of text recall protocols into hierarchies of propositions (Turner & Greene, Note 14) and categories of recall (Drum & Lantaff, Note 7), propositional units in text recall and text entailed recall categories were assigned hierarchical levels. Hierarchical levels were defined in the following manner: High level propositions were comprised of propositions from the first and second levels in the text hierarchy of propositions. Medium level propositions consisted of propositions from the third and fourth levels in the text hierarchy of propositions. Low level propositions consisted of propositions from the fifth and sixth levels in the text hierarchy of propositions. Text evoked and text external recall categories were omitted from this assignment because, in many cases, the relationship between recall propositional units and template text propositional units was too vague to allow for one-to-one comparisons.

Proportions of propositional units recalled at each hierarchical level as a fraction of total proportions of propositions found at each hierarchical level in template texts (Table 4.6) were calculated. These data were used to study the effect of text structure on the recall of propositional units at specific hierarchical levels in the text base.

Results

Two three way analyses of variance were conducted to test Hypothesis 1.4. The three factors consisted of (A) text structure, (B) time of recall and (c) hierarchical levels of information in the text. Analyses were conducted for both NERVE CELLS and TELEPHONE content topics. Tables 5.14 and 5.15 summarize the analysis of variance for NERVE CELLS and TELEPHONE content topics, respectively. Figures 5.13, 5.14 and 5.15 graphically represent the significant interactions evidenced from the analysis.

Newman-Keuls post hoc comparisons of mean recall scores at specific hierarchical levels indicated which scores were significantly different from one another (Winer, 1971, p. 217). These are summarized in Table 5.16.

NERVE CELLS Texts: Significant main effects due to structure $F(1,31) = 5.56$, $p \leqslant .05$; time of recall $F(1,160) = 59.74$, $p \leqslant .001$ and hierarchical levels of information in text $F(2,160) = 14.32$, $p \leqslant .001$ were evident in the NERVE CELLS texts.

No significant interactions between factors were found for NERVE CELLS texts.

TELEPHONE Texts: In the TELEPHONE texts significant main effects due to time of recall $F(1,160) = 27.56$, $p \leqslant .001$, and hierarchical levels of information in the text, $F(2,160) = 19.52$, $p \leqslant .001$ were found. In addition, text structures were found to significantly affect the proportions of recall propositions at each hierarchical level of information in the text, $F(2.160) = 14.55$, $p \leqslant .001$. The interaction is graphed in Figure 5.13.

The time of recall was found to affect significantly the proportions of propositions recalled at specific levels in the text hierarchy, $F(2,160) = 4.99$, $p \leqslant .01$. In both immediate and delayed recall conditions, proportionately more text propositions were recalled at the high hierarchical level, than the medium level, and

Table 5.14

NERVE CELLS Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Hierarchical Levels of Information in Text

Source of Variation	SS	df	MS	F	p
Between subjects	6865.910	31			
A	1073.254	1	1073.254	5.56	0.0251117*
Subj W Group	5792.656	30	193.089		
Within subjects	32404.523	160			
B	5299.629	1	5299.629	59.74	0.0000008***
AB	264.621	1	264.621	2.98	0.0944272
B x Subj W Group	2661.281	30	88.709		
C	4660.031	2	2330.016	14.32	0.0000091***
AC	373.004	2	186.502	1.15	0.3247034
C x Subj W Group	9762.852	60	162.714		
BC	535.816	2	267.908	1.93	0.1547465
ABC	497.762	2	248.881	1.79	0.1760128
BC x Subj W Group	8349.527	60	139.159		

* $p \leq .05$
*** $p \leq .001$

Table 5.15

TELEPHONE Texts
Summary of Analysis of Variance due to (A) Structure, (B) Time of Recall and (C) Hierarchical Levels of Information in Text

Source of Variation	SS	df	MS	F	p
Between subjects	9165.398	31			
A	302.867	1	302.867	1.03	0.3193821
Subj W Group	8862.531	30	295.417		
Within subjects	31075.160	160			
B	4729.922	1	4729.922	27.56	0.0000122***
AB	16.027	1	16.027	0.09	0.7620139
B x Subj W Group	5148.137	30	171.605		
C	4584.266	2	2292.133	19.52	0.0000006***
AC	3417.340	2	1708.670	14.55	0.0000077***
C x Subj W Group	7044.012	60	117.400		
BC	712.891	2	356.445	4.99	0.0099099**
ABC	1135.031	2	567.516	7.94	0.0008711***
BC x Subj W Group	4287.535	60	71.459		

** $p \leqslant .01$

*** $p \leqslant .001$

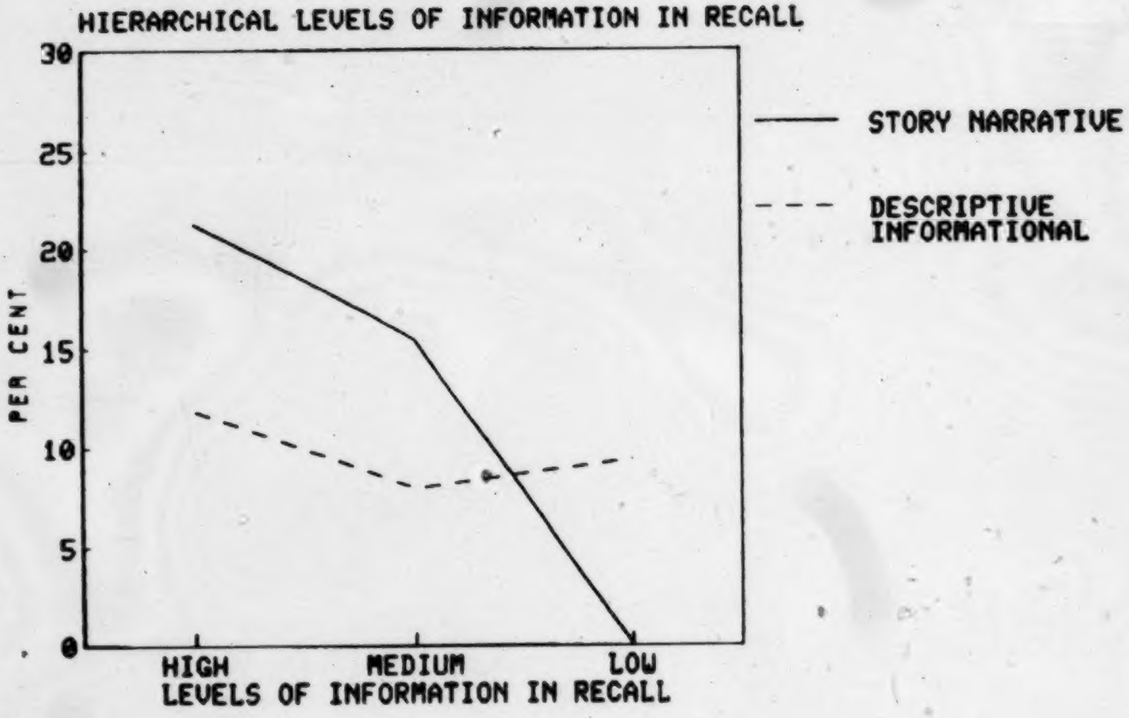


Figure 5.13

TELEPHONE Texts
Mean Recall Proportions for (A) Text Structure and
(C) Hierarchical Levels of Information in Text
for the Analysis of Variance
($p < .001$)

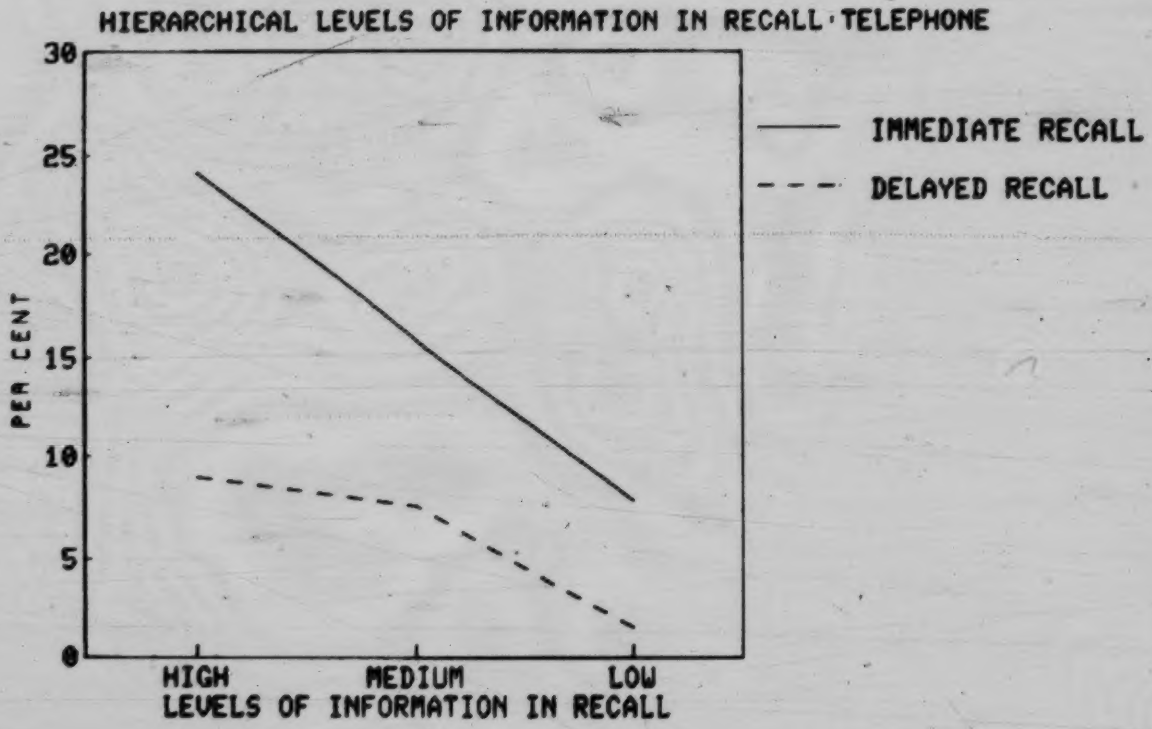


Figure 5.14

TELEPHONE Texts
Mean Recall Proportions for (B) Time of Recall and
(C) Hierarchical Levels of Information in
Text for the Analysis of Variance
($p \leq .01$)

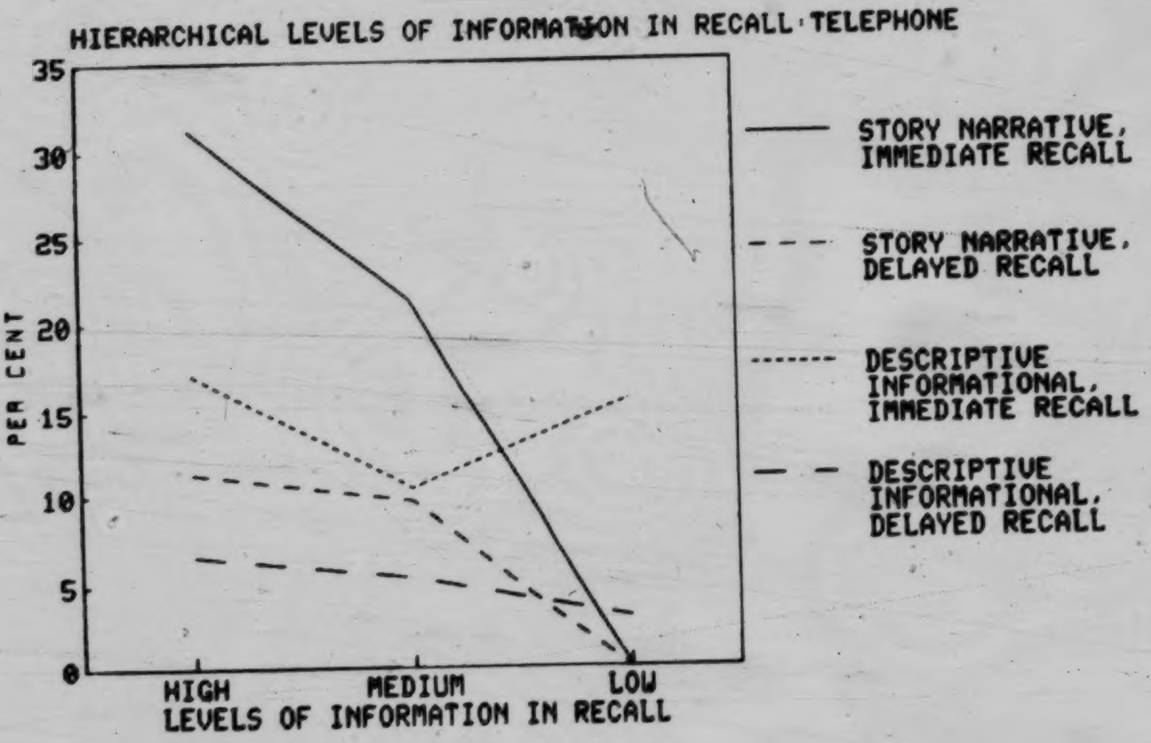


Figure 5.15

TELEPHONE Texts
Mean Recall Proportions for (A) Text Structure, (B) Time of Recall
and (C) Hierarchical Levels of Information in Text
for the Analysis of Variance
(p ⩽ .001)

Table 5.16

Summary of Comparisons of Post Hoc Means
Newman-Keuls Method for Hierarchical Levels of Information
in Recall—NERVE CELLS, TELEPHONE Texts

NERVE CELLS		TELEPHONE	
Comparison	Significance Level	Comparison	Significance Level
STORY NARRATIVE - Immediate		STORY NARRATIVE - Immediate	
(H) 25.694 - (L) 12.499		(H) 31.250 - (L) 0.000	**
(M) 18.453 - (L) 12.499		(M) 21.250 - (L) 0.000	**
(H) 25.694 - (M) 18.453		(H) 31.250 - (M) 21.250	**
STORY NARRATIVE - Delayed		STORY NARRATIVE - Delayed	
(M) 9.226 - (L) 0.000	**	(H) 11.299 - (L) 0.000	**
(H) 8.854 - (L) 0.000	**	(M) 9.688 - (L) 0.000	**
(M) 9.226 - (H) 8.854		(H) 11.299 - (M) 9.688	
DESCRIPTIVE INFORMATIONAL - Immediate		DESCRIPTIVE INFORMATIONAL - Immediate	
(M) 19.271 - (L) 0.000	**	(H) 17.189 - (M) 10.417	
(H) 16.146 - (L) 0.000	**	(L) 15.625 - (M) 10.417	
(M) 19.271 - (H) 16.146		(H) 17.189 - (L) 15.625	
DESCRIPTIVE INFORMATIONAL - Delayed		DESCRIPTIVE INFORMATIONAL - Delayed	
(M) 6.771 - (L) 0.000	**	(H) 6.642 - (L) 3.125	
(H) 4.167 - (L) 0.000	*	(M) 5.417 - (L) 3.125	
(M) 6.771 - (H) 4.167		(H) 6.642 - (M) 5.417	

(H) - High Level Propositions Recalled
(M) - Medium Level Propositions Recalled
(L) - Low Level Propositions Recalled

* $p \leq .05$
** $p \leq .01$

proportionately more text propositions were recalled at the medium hierarchical level than the low hierarchical level. This information is presented graphically in Figure 5.14.

Text recall proportions at specific levels in the text hierarchy of propositions were significantly different in STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text structures, at immediate and delayed times of recall, $F(2,160) = 7.94$, $p < .001$. In the STORY NARRATIVE immediate and delayed recall conditions, and the TELEPHONE delayed recall condition, proportions of propositions recalled decreased according to descending hierarchical levels of information in text. However, in the TELEPHONE immediate recall condition, the proportion of propositions recalled at the low hierarchical level was higher than the proportion of propositions recalled at the medium hierarchical level. This information is graphed in Figure 5.15.

Discussion

Competent readers have been shown to recall the more general, thematic ideas from text (Kintsch, 1974; Meyer, 1975; DeFratis Evans, 1977) whether this is assessed in terms of the propositional argument repetition rule (Kintsch, Note 1), content high in the text hierarchy (Meyer, 1975), old topic information (Clements, 1976) or old information (DeFratis Evans, 1977).

Recall of propositional units from STORY NARRATIVE texts followed patterns of informational retrieval which the researchers mentioned above had indicated. More high hierarchical level propositions were recalled than propositions at the medium hierarchical level, and more propositions at the medium hierarchical level were recalled than propositions at the low level in the hierarchy of text information. However, for DESCRIPTIVE INFORMATIONAL texts, recall behavior was not similar to the patterns of information retrieval which has been established for STORY NARRATIVE texts.

In the NERVE CELLS DESCRIPTIVE INFORMATIONAL text mean proportions recalled from propositions high in the hierarchy of text information were lower than mean proportions recalled at the medium hierarchical level. In the TELEPHONE DESCRIPTIVE INFORMATIONAL text, mean proportions recalled from propositions at the medium hierarchical level were lower than mean proportions recalled from propositions low in the text hierarchy. (See Table 5.16.)

These two results can be explained in terms of the specific non-thematic ideas which occur in text, ideas which are not central to the main ideas presented in the text. Examples of this in the DESCRIPTIVE INFORMATIONAL texts are often modifier propositions, i.e., silver salts, tiny gaps, the branches didn't really join at all (NERVE CELLS DESCRIPTIVE INFORMATIONAL text). Meyer (1977) has commented on the nature of this type of recall:

> The pattern of specific relationships of the content structure has no influence over what is recalled at the lowest levels of the structure. Information at this level is not recalled by many people, and what is remembered by some people appears to be due to the particularities of the content, striking qualities such as familiar proper names and numbers. (p. 330)

Often non-thematic ideas are recalled because of their novelty, or because of their association with specific events in the prior experience of the reader.

Such results also indicate the influence of the STORY NARRATIVE structure in recall. Because the readers are less familiar with the

DESCRIPTIVE INFORMATIONAL structure, they are less likely to recall text in an ordered manner but tend to recall unrelated facts from text.

V. ANALYSIS 5: TEMPLATE TEXT POSITION OF PROPOSITIONS IN RECALL

Purpose

Several studies of recall of text have sought to answer the question: What part of a text is best recalled? (Glenn, 1977; Kintsch & Kozminsky, 1977; Mandler & Johnson, 1977; Stein & Glenn, 1977; Stein, Note 15; Stein & Nezworski, Note 18). This analysis was conducted to see if proficient sixth grade readers when reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts remembered text propositional units from different positions in the template texts.

Design

A 2 x 2 x 3 between subjects design was used. There were two levels of factor A (STRUCTURE: STORY NARRATIVE, DESCRIPTIVE INFORMATIONAL), two levels of factor B (TIME OF RECALL: immediate, delayed) and three levels of factor C (POSITION IN RECALL: theme, body, resolution—for STORY NARRATIVE texts, and topic identification, topic expansion, conclusion statements—for DESCRIPTIVE INFORMATIONAL texts). The design is shown in Figure 5.16, and was used for both NERVE CELLS and TELEPHONE TOPICS, to test Hypothesis 1.5.

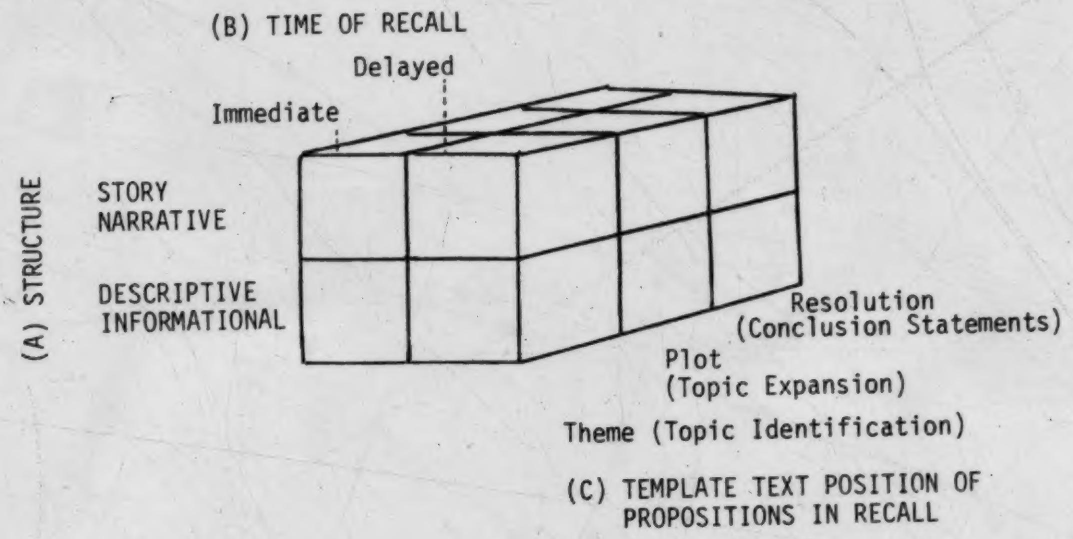

(B) TIME OF RECALL
Delayed
Immediate
(A) STRUCTURE
STORY NARRATIVE
DESCRIPTIVE INFORMATIONAL
Resolution (Conclusion Statements)
Plot (Topic Expansion)
Theme (Topic Identification)
(C) TEMPLATE TEXT POSITION OF PROPOSITIONS IN RECALL

Figure 5.16

Design for Analysis 5

Procedure

Each passage was divided into three major sections according to the structural organization figures illustrated in Chapter 4 (Figures 4.2, 4.3, 4.4, 4.5).

STORY NARRATIVE passages were divided into

i. Setting and theme
ii. Plot
iii. Resolution.

DESCRIPTIVE INFORMATIONAL passages were divided into

i. Topic identification
ii. Topic expansion
iii. Conclusion statements.

For the purpose of this analysis, propositions from text and text entailed categories of recall were utilized. Comparisons between recall propositions from text evoked and text external categories, and the template texts from which subjects had read, were generally too vague to be of anything but limited value.

Proportions of propositions recalled from each section of the text were calculated as a fraction of the total number of propositions within each text section.

Results

Two three way analyses of variance were conducted to test Hypothesis 1.5. The three factors consisted of (A) text structure, (B) time of recall and (C) position in recall. Analyses were conducted for both NERVE CELLS and TELEPHONE content topics. Table 5.17 and 5.18 summarize the analysis of variance for NERVE CELLS and TELEPHONE content topics, respectively. Figures 5.17, 5.18, 5.19 and 5.20 graphically represent the significant interactions evidenced from these analyses.

The Newman-Keuls method was used to compare the mean scores of propositions recalled from specific positions in the template texts (Winer, 1971). Information from this analysis is found in Table 5.19.

NERVE CELL Texts: Significant main effects were found for structure $\underline{F}(1,31) = 21.06$, $\underline{p} \leq .001$ and time of recall $\underline{F}(1,160) = 47.21$, $\underline{p} \leq .001$.

The proportions of propositional units recalled at immediate and delayed recall conditions differed significantly for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts $\underline{F}(1,160) = 4.76$, $\underline{p} \leq .05$. This interaction is graphically represented in Figure 5.17.

Table 5.17

NERVE CELLS Texts
Summary of Analysis of Variance due to (A) Structure,
(B) Time of Recall and (C) Template Text Position
of Propositions Recalled

Source of Variation	SS	df	MS	F	p
Between subjects	14159.043	31			
A	5840.094	1	5840.094	21.06	0.0000747***
Subj W Group	8318.949	30	277.298		
Within subjects	40393.074	160			
B	8385.125	1	8385.125	47.21	0.0000008***
AB	845.250	1	845.250	4.76	0.0371124*
B x Subj W Group	5328.031	30	177.601		
C	20.289	2	10.145	0.05	0.9503354
AC	5443.609	2	2721.805	13.68	0.0000138***
C x Subj W Group	11938.551	60	198.976		
BC	119.359	2	59.680	0.55	0.5775186
ABC	1850.273	2	925.137	8.59	0.0005235***
BC x Subj W Group	6462.676	60	107.711		

* p < .05

*** p < .001

Table 5.18

TELEPHONE Texts
Summary of Analysis of Variance due to (A) Structure,
(B) Time of Recall and (C) Template Text Position
of Propositions Recalled

Source of Variation	SS	df	MS	F	p
Between subjects	32209.625	31			
A	4815.625	1	4815.625	5.27	0.0288094*
Subj W Group	27394.000	30	913.133		
Within subjects	126775.750	160			
B	9529.875	1	9529.875	17.32	0.0002450***
AB	3288.750	1	3288.750	5.98	0.0205852*
B x Subj W Group	16507.313	30	550.244		
C	23762.625	2	11881.313	16.26	0.0000020***
AC	1954.313	2	977.156	1.34	0.2703105
C x Subj W Group	43847.688	60	730.795		
BC	1255.938	2	627.969	1.50	0.2319423
ABC	1467.500	2	733.750	1.75	0.1825765
BC x Subj W Group	25161.750	60	419.362		

* $p \leqslant .05$

*** $p \leqslant .001$

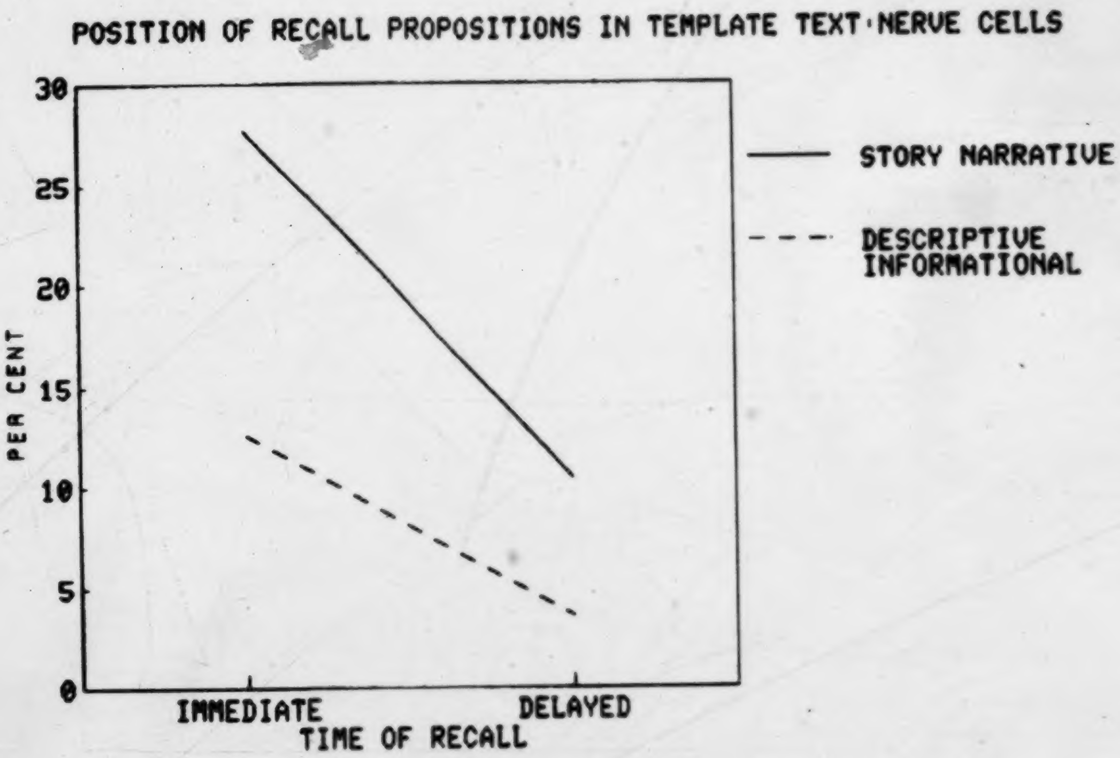


Figure 5.17

NERVE CELLS Texts
Mean Recall Proportions for (A) Text Structure and
(B) Time of Recall for the Analysis of Variance
($p \leq .05$)

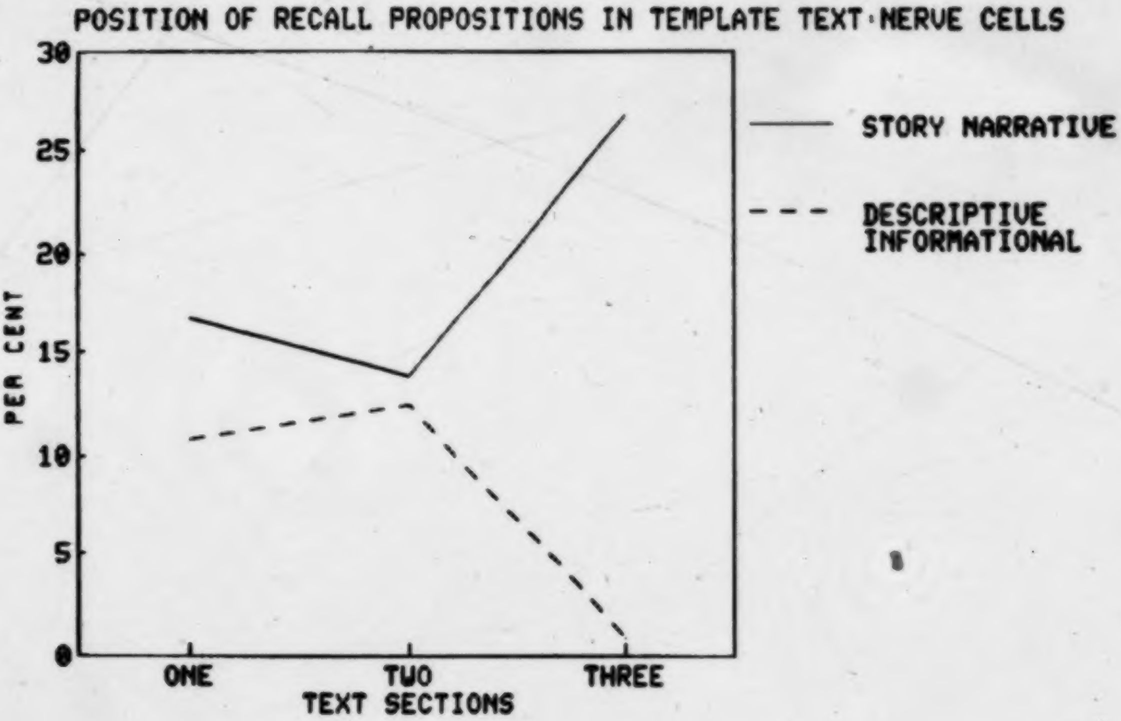


Figure 5.18

NERVE CELLS Texts
Mean Recall Proportions for (A) Text Structure and
(C) Template Text Position of Recall Propositions
for the Analysis of Variance
(p ≤ .001)

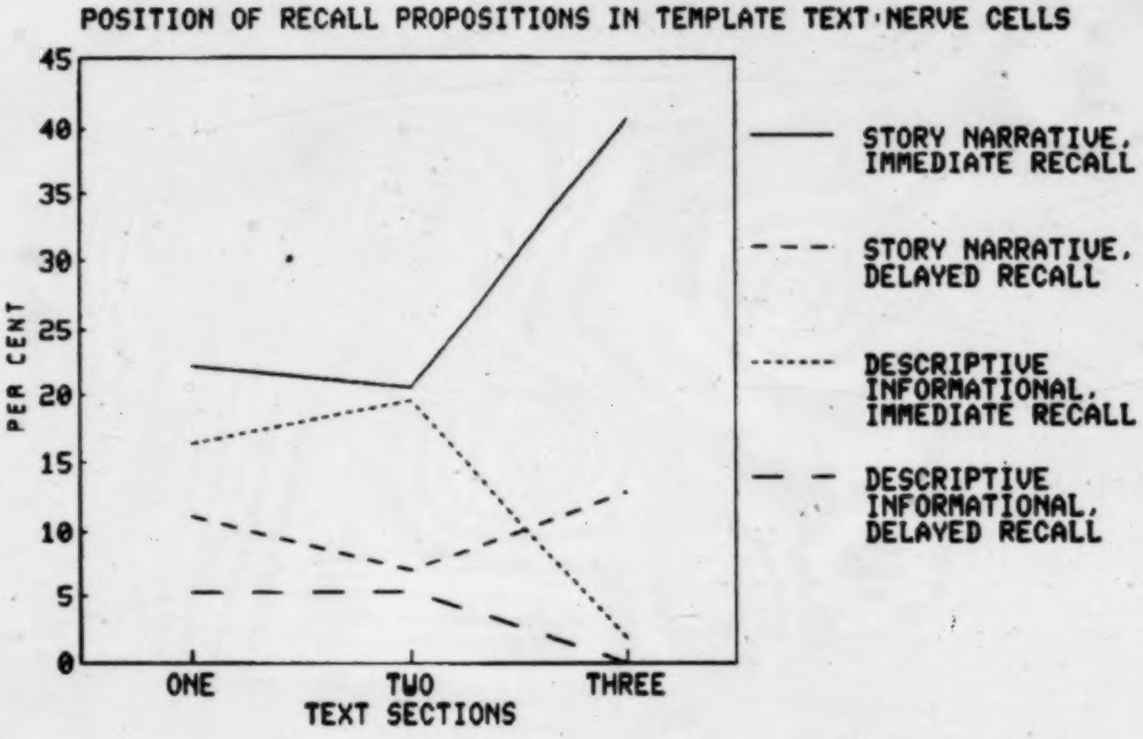


Figure 5.19

NERVE CELLS Texts
Mean Recall Proportions for (A) Text Structure, (B) Time of
Recall and (C) Template Text Position of Recall
Propositions for the Analysis of Variance
($p \leq .001$)

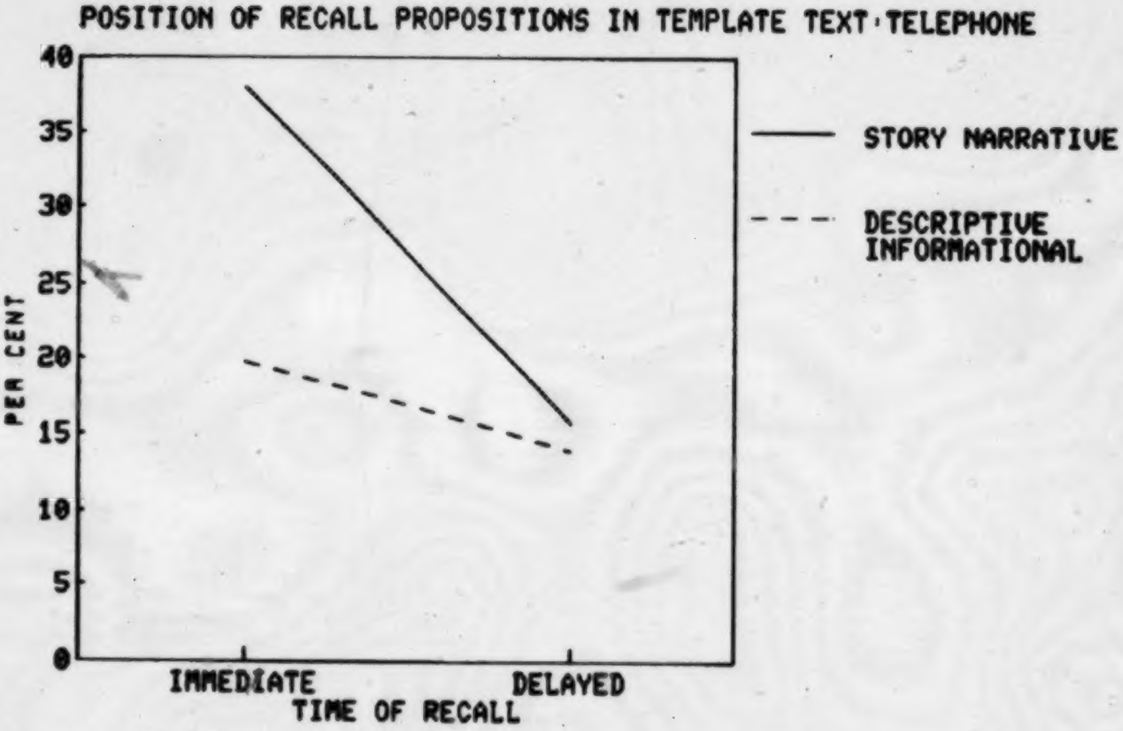


Figure 5.20

TELEPHONE Texts
Mean Recall Proportions for (A) Text Structure and (B) Time of Recall for the Analysis of Variance
($p < .05$)

Table 5.19

Summary of Post Hoc Comparisons of Means
Newman-Keuls Method for Template Text Position of Recall—
NERVE CELLS, TELEPHONE Texts

NERVE CELLS		TELEPHONE	
Comparison	Significance Level	Comparison	Significance Level
STORY NARRATIVE - Immediate		STORY NARRATIVE - Immediate	
(R) 40.624 - (P) 20.513	**	(R) 56.249 - (P) 15.897	**
(R) 40.624 - (T) 22.206	**	(T) 41.964 - (P) 15.897	**
(T) 22.206 - (P) 20.513		(R) 56.249 - (T) 41.964	
STORY NARRATIVE - Delayed		STORY NARRATIVE - Delayed	
(R) 12.891 - (P) 7.051		(R) 31.250 - (P) 5.041	**
(R) 12.891 - (T) 11.161		(R) 31.250 - (T) 10.716	*
(T) 11.161 - (P) 7.051		(T) 10.716 - (P) 5.041	
DESCRIPTIVE INFORMATIONAL - Immediate		DESCRIPTIVE INFORMATIONAL - Immediate	
(P) 19.531 - (R) 1.786	**	(R) 28.124 - (P) 14.061	
(T) 16.346 - (R) 1.786	**	(R) 28.124 - (T) 17.044	
(P) 19.531 - (T) 16.346		(T) 17.044 - (P) 14.061	
DESCRIPTIVE INFORMATIONAL - Delayed		DESCRIPTIVE INFORMATIONAL - Delayed	
(P) 5.313 - (R) 0.000	*	(R) 31.247 - (P) 4.861	*
(T) 5.288 - (R) 0.000	*	(R) 31.247 - (T) 5.681	*
(P) 5.313 - (T) 5.288		(T) 5.681 - (P) 4.861	

(T) - Theme/Topic identification propositions
(P) - Plot/Topic expansion propositions
(R) - Resolution/Conclusion propositions

* $p < .05$
** $p < .01$

Text structure was found to significantly affect the recall of text from specific positions within the template text, $F(2,160) = 13.68$, $p \leq .001$. This interaction is graphed in Figure 5.18.

The effect of text structure on the recall of text from specific positions within the text was significant in both recall conditions, $F(2,160) = 8.59$, $p \leq .001$. Figure 5.19 represents this interaction graphically.

TELEPHONE Texts: Significant main effects were noted for structure $F(1,31) = 5.27$, $p \leq .05$, time of recall $F(1,160) = 17.32$, $p \leq .001$, and template text position of recall propositions $F(2,160) = 16.26$, $p \leq .001$.

The proportions of propositions recalled at immediate and delayed recall conditions differed significantly for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts, $F(1,160) = 5.98$, $p \leq .05$. Figure 5.20 graphically represents this interaction.

Discussion

In both NERVE CELLS and TELEPHONE content topics, the proportion of propositional units recalled at immediate and delayed conditions differed significantly for STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts. In both cases, the amount recalled in both recall conditions was higher for STORY NARRATIVE texts. However, the amount forgotten from STORY NARRATIVE texts between immediate and delayed recall tasks was greater than the amount forgotten from DESCRIPTIVE INFORMATIONAL texts.

In the NERVE CELLS texts the significant differences between STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL text recalls from specific positions within text can be attributed to the influence of text structure on recall. In both content topics, proportionately more was recalled within the STORY NARRATIVE structure from all three sections, than was recalled within a DESCRIPTIVE INFORMATIONAL text structure. Whereas children expect a STORY NARRATIVE to have an ending (Mandler & Johnson, 1977), "the happily ever after" part of a story, they are not necessarily familiar with the conclusive summary or evaluative statement which ends a DESCRIPTIVE INFORMATIONAL text.

Thus, in this study, proficient sixth grade readers read and recalled:

> "Golgi was awarded a Nobel Prize in 1906 for the work he did on the structure of the nervous system" (NERVE CELLS STORY NARRATIVE text)

much better than

> "Knowing about nerve cells has helped scientists to know more about the structure of the nervous system" (NERVE CELLS DESCRIPTIVE INFORMATIONAL text).

In the TELEPHONE texts, the lack of significant difference between recalls of STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts from specific positions within text can be explained by the poorly differentiated concluding statement in the TELEPHONE DESCRIPTIVE INFORMATIONAL text:

> "The person you are talking to hears this copy of the sounds of your voice" (TELEPHONE DESCRIPTIVE INFORMATIONAL text).

However, although non-significant, the mean recall proportion from the conclusion statement of the TELEPHONE DESCRIPTIVE INFORMATIONAL text ($\overline{X}$ = 29.686) was much lower than the mean recall proportion from the resolution of the TELEPHONE STORY NARRATIVE text ($\overline{X}$ = 43.749).

These results can be explained in terms of the categories which Stein and Glenn (Note 19) include in a simple story. Their consequence category: "an event, action or endstate which marks the attainment or non-attainment of the protagonist's goal" (p. 2) was one of the three most frequently recalled story categories across four stories which children had heard in the normally expected sequence. This consequence category is similar to the resolution section in STORY NARRATIVE texts as defined in this study. Conversely, their reaction category: "an emotion, cognition, action or endstate expressing the protagonist's feelings about his goal attainment or relating the broader consequential realm of the protagonist's goal attainment" (p. 2) was one of the three least frequently recalled story categories across the same four stories. The reaction category can be paralleled with the concluding statements section for DESCRIPTIVE INFORMATIONAL texts in this study.

Similarities in definition allow this researcher to conclude that recall behaviors evidenced from both STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts are consistent with earlier studies of this nature with children (Stein & Glenn, Note 19) and with adult subjects (Mandler & Johnson, 1977).

VI. ANALYSIS 6: INTERVIEWS TO PROBE CHILDREN'S KNOWLEDGE ABOUT READING AND MEMORY TASKS

Purpose

Children at different developmental levels are differentially aware of how to remember. An interview study by Kreutzer et al. (1975) suggested specific types of metamemorial strategies which are available to children at certain grade levels. Metamemory was defined as "the individual's potentially verbalizable knowledge and awareness concerning any aspect of information storage and retrieval" (p. 1). The researchers involved in the study noted, particularly, that children in Grades 3 and 5 were considerably more "planful" in their use of mnemonic strategies than children in Kindergarten and Grade 1. The older children saw themselves and others as potentially able to remember information, and understood more clearly how relations among items (as contrasted with their individual properties) can often influence retrieval.

The purpose of this experiment was to see if structural variables within text affected the metamemorial strategies used by proficient sixth grade readers when reading and recalling text.

Procedure

On completion of recall tasks in the delayed recall condition (Analysis 1), each subject was asked the following questions:

1. What do you think were the main differences between the two passages?

2. What did you do to remember?

3. Which passage did you remember better?
4. Why?

Responses to these questions were transcribed for later descriptive analysis.

Results and Discussion

The analysis of responses involved categorization after initial separation into four sections corresponding to the four questions asked of the subjects. Each section will be discussed separately, at first.

1. Main Differences between Passages

After initial perusal of responses, a category system used in Table 5.20 was devised which encompassed all of the questions produced by subjects, in answer to the question: What do you think were the main differences between the two passages?

Table 5.20

Subject-Defined Text Differences
(What do You Think are the Main Differences between these Two Passages?)
Number of Subjects by Category

Subject Response Categories		
i.	Content differences	13/32
ii.	Different discoveries	7/32
*iii.	Process description vs. story about a person	6/32
iv.	Text function difference	1/32
v.	Null response	5/32

Response categories which answered this question were defined as follows:

Content differences. Subjects responded by comparing text contents.

> "Um . . . well ah, one was about nerves 'n the other was about how ah, the electricity is used in the telephone." (Subject 17)

Different discoveries. Subjects viewed texts as describing different inventions or discoveries. e.g.

> "Well one was about an invention that um, a mechanical invention. The other one was an invention for your body." (Subject 28)

Process description vs. story about a person. Subjects differentiated texts by the fact that one talked about a person, while the other described a process. e.g.

> "Well, like one was talking about a man and what he discovered an' the other one's talking about how something works." (Subject 3)

Text function differences. Subjects compared texts according to their application by specific people. e.g.

> "Well one was about, well they were both about inventions, but one was more useful than the other for more people. One was used for doctors and the other was used for a whole group of people, almost everybody." (Subject 26)

Null response. Subject answered "I don't know."

Of the responses categorized, six subjects viewed text differences in a manner similar to that of the researcher's basis for text development. An inspection of proportions of propositions recalled in text and text entailed categories for these six subjects suggested that such a concept of text may have guided recall of text. Many scores obtained by these six subjects (see Table 5.21) were higher

Table 5.21

Proportion of Propositions Recalled from Text (Text and Text Entailed Recall Categories) for Six Subjects whose Concept of Text Differences was the Same as Those Established at the Onset of the Study

Subject	Boy/Girl	Text One	Imm.	Delayed	Text Two	Imm.	Delayed
3	B	TI	22.45*	14.29*	NN	30.51*	13.56*
8	G	NI	16.95	18.64*	TI	15.33*	4.08*
9	B	TI	4.08	0	NN	5.08	6.78*
29	B	NI	25.00*	10.00*	TN	43.48*	0
30	G	NN	28.81*	13.56*	TI	24.49*	22.45*
31	B	TN	28.26*	0	NI	8.33	0

* Higher than the mean score.

than the mean score for a particular structure and content topic.

Most subjects saw the main differences between texts as a difference between two content topics (13/32). Such a distinction may have aided retrieval strategies for those children. Interestingly enough, those children whose response was null, obtained the following recall proportions: proportionately fewer obtained scores above the mean score for recall proportions, than the six subjects whose concept of text differences matched those established for the study. (See Table 5.22.)

Table 5.22

Proportion of Propositions Recalled from Text (Text and Text Entailed Recall Categories) for Five Subjects who Could See No Main Differences between Texts

Subject	Boy/Girl	Text One	Imm.	Delayed	Text Two	Imm.	Delayed
2	G	TN	23.91*	4.35	NI	25.00*	0
16	G	TI	10.20*	0	NN	25.42*	5.08
18	G	TN	4.35	6.52	NI	8.33	8.33*
22	G	TI	6.12	4.08*	NN	18.64	15.25*
32	G	TI	8.16	6.12*	NN	25.42*	6.78*

* Higher than mean score.

2. Strategies for Remembering

Responses to the question What did you do to remember? were categorized. This question was ambiguous in that it gave rise to two types of response. Eight subjects viewed the question as asking what purposeful strategies they engaged in for later retrieval of information.

Conversely, the remaining 24 subjects viewed the question as calling for a description of their specific retrieval strategies during recall. Responses were categorized keeping in mind this distinction.

Response categories were defined as follows:

a. Purposeful strategies for later retrieval

   i. Careful reading of text. Subjects responded by saying, e.g.,

   "Um . . . that's a hard one um . . . I didn't really do anything I just read it carefully." (Subject 17)

   ii. Memorization. Subjects engaged in rote memorization strategies. e.g.

   "I read it then um I memorized it." (Subject 23)

   iii. Repeated reading of text. Subjects read texts more than once. e.g.

   "Boy! Well I read the thing over a couple of times, the parts that were important." (Subject 12)

b. Retrieval strategies during recall

   i. Memory search. Subjects actively searched memory stores. e.g.

   "I . . . er - I sort of, went back in my mind to see if I knew anything." (Subject 1)

   ii. Thought about text content. Subjects thought about texts they had read. e.g.

   "I jest tried to think of the people." (Subject 20)

   "Well I tried to remember the main points those which I found were the most important." (Subject 21)

   iii. Relation to prior knowledge. Subjects associated text information with previous related information. e.g.

   "Well I read them . . . well I didn't remember both of them I just remember one . . . 'cos like we're taking it in school, like we took nerve cells in the school." (Subject 14)

iv. Automatic retrieval. Subjects did not consciously use retrieval strategies. e.g.

"I jest remembered it." (Subject 24)

"I dunno . . . um . . . I didn't really think about it until now." (Subject 26)

v. Expected retrieval. Subjects consciously did not use retrieval strategies because they expected recall after reading. e.g.

"Well, usually when I read something I always remember it." (Subject 18)

These responses (Table 5.23) reflect the "planfulness" of upper elementary children found by Kreutzer et al. (1975). It is important to note that these conscious strategies may not be the total of strategies used by each individual to remember for later recall, and to retrieve during recall. However they do reflect the variety of mnemonic strategies which proficient sixth grade readers have at their disposal.

Table 5.23

Strategies for Remembering
Number of Subjects by Category

Subject Response Categories	
a. Purposeful strategies for later retrieval	
i. Careful reading of text	3/32
ii. Memorization	2/32
iii. Repeated reading of text	3/32
b. Retrieval strategies during recall	
i. Memory search	6/32
ii. Thought about text content	6/32
iii. Relation to prior knowledge	2/32
iv. Automatic retrieval	8/32
v. Expected retrieval	2/32

3. Rating of Mnemonic Strategies for Different Texts

Subjects were asked which text they remembered better. Responses were categorized, following initial inspection, according to subjects' choices and a comparison made with the experimental texts which subjects had read. In addition, subjects were asked why they thought one text was better remembered than the other. Why responses were categorized according to the following definitions:

Prior knowledge. Subjects related increased recall to associated prior knowledge. e.g.

> "Well because I took it . . . a little about it in Grade Four, but, that was it. I jest . . . kinda like doing stuff with electronics sometimes." (Subject 3)

Interest factor. Subjects related increased recall to associated interest factors. e.g.

> "I think it was more interesting because I never heard about it before." (Subject 26)
>
> "I dunno . . . it was kinda more interesting to me." (Subject 5)

Practice effect. Subjects related increased recall to the effects of practising reading and recall tasks. e.g.

> "Mm . . . I think I mighta read it more carefully than the other one." (Subject 10)

Specific text difficulty. Subjects related increased recall to mechanics specifics such as vocabulary difficulty. e.g.

> "I don't know . . . I guess partly it was because there were . . . like some of the words were a bit easier." (Subject 30)

Miscellaneous responses.

> "I dunno just remember it." (Subject 21)
>
> "I don't know. I guess it was just maybe easier for me to remember." (Subject 22)

Null response. Subjects had no reason for increased recall in one text.

Information summarizing these responses is found in Table 5.24.

Discussion

Categorization of interview responses yielded information about how children consciously perceive reading and recall tasks. Many subjects differentiated texts by their content. A small group of subjects distinguished texts in a way which was similar to the criteria of differentiation used in developing the texts. More of this group's scores for proportions of propositions recalled were higher than the mean recall scores for each content and structure, than the scores of the group of subjects who had differentiated texts by their content. Although this effect of use of a similar text conception to the author was not tested for significance, it suggests that conscious knowledge of differential text structures can aid recall.

The high level of sophisticated use of varying conscious mnemonic strategies was emphasized by the subjects' responses to the question: What did you do to remember? Strategies in which proficient sixth grade readers engage for adequate information retrieval include careful reading of text, memorization and repeated reading of text. To enhance retrieval strategies during recall, these readers

Table 5.24

Which Text did you Remember Better? Why?

Subj. Number	Sex	Experimental Assignment	Preferred Text NERVE CELLS	Preferred Text TELEPHONE	Text Structure of Preferred Text	Reason
1	B	NSN TDI		✓	*	Null response
2	G	TSN NDI		✓	Δ	Prior knowledge
3	B	TDI NSN		✓	*	Prior knowledge
4	G	NDI TSN		✓	Δ	Prior knowledge
5	B	TSN NDI		✓	Δ	Interest effect
6	G	TDI NSN	✓		Δ	Practice effect
7	B	NDI TSN		✓	Δ	Null response
8	G	NSN TDI	✓		Δ	Prior knowledge
9	B	TDI NSN	✓		Δ	Specific text difficulty
10	G	NDI TSN		✓	Δ	Practice effect
11	B	NSN TDI	indiscriminate response			Practice effect
12	G	TSN NDI		✓	Δ	Interest factor
13	B	NDI TSN		✓	Δ	Interest factor
14	G	NSN TDI	✓		Δ	Prior knowledge
15	B	TSN NDI		✓	Δ	Interest factor
16	G	TDI NSN	✓		Δ	Interest factor
17	B	NSN TDI		✓	*	Interest factor
18	G	TSN NDI		✓	Δ	Prior knowledge
19	B	TDI NSN	✓		Δ	Interest factor
20	G	NDI TSN		✓	Δ	Prior knowledge
21	B	TSN NDI	✓		*	Miscellaneous
22	G	TDI NSN	✓		Δ	Miscellaneous
23	B	NDI TSN		✓	Δ	Interest factor
24	G	NSN TDI	✓		Δ	Prior knowledge
25	B	TDI NSN		✓	*	Prior knowledge
26	G	NDI TSN	✓		*	Interest factor
27	B	NSN TDI		✓	*	Prior knowledge
28	G	TSN NDI		✓	Δ	Prior knowledge
29	B	NDI TSN	✓		*	Interest factor
30	G	NSN TDI		✓	*	Specific text difficulty
31	B	TSN NDI		✓	Δ	Prior knowledge
32	G	TDI NSN	✓		Δ	Practice effect

Δ STORY NARRATIVE

* DESCRIPTIVE INFORMATIONAL

consciously searched memory, thought about the content of text, related text information to prior knowledge and even expected that high level retrieval would be the automatic, anticipated product of reading.

When asked to state which text was better remembered, 22/31 subjects chose the content topic with the STORY NARRATIVE structure. This suggested that, at least unconsciously, the STORY NARRATIVE structure facilitated comprehension and recall of information. Nine subjects chose content topics with DESCRIPTIVE INFORMATIONAL text structures, seven for the following reasons: prior knowledge, interest factors and the specific text difficulty of the NERVE CELLS text. One subject failed to discriminate between texts. Reasons for remembering one text better than another included prior knowledge of the content of a text, interest in text content, the practice effect of having completed one reading and recall task, the specific difficulty of one text in terms of vocabulary difficulty, miscellaneous reasons and no reason at all.

Evidence was cited that the text structure variable was consciously noted by several sixth grade proficient readers. The paucity of questions and the lack of probing hindered elaboration of results. However, the interviews did indicate the variety of strategies which proficient readers both consciously and unconsciously use to recall texts differing by content and structure.

VII. CHAPTER SUMMARY: THE INFLUENCE OF SPECIFIED TEXT VARIABLES ON DIFFERING TEXT STRUCTURES AND THEIR RELATIONSHIP TO THE COMPREHENSION AND RECALL PROCESSES

This study viewed the changes which occur in certain text variables when the structure of text varies.

STORY NARRATIVE recall proportions were found to be significantly different from DESCRIPTIVE INFORMATIONAL recall proportions in both content topics, and in both immediate and delayed recall conditions.

Text structure did not significantly affect the recall of information in specific categories of recall. Whereas Drum (Note 15) had differentiated able from less able readers by their consistent recall of information which was text or text entailed, the proficient readers involved in this study could not be differentiated in the same way. Grade level and therefore reading experience differences were attributed to the differences in these results.

In STORY NARRATIVE texts, predicate propositions were recalled more frequently than in DESCRIPTIVE INFORMATIONAL texts, suggesting that the STORY NARRATIVE text structure may convey the actions or states described in a more coherent manner for recall. Connective propositions were also recalled more frequently in STORY NARRATIVE texts than in DESCRIPTIVE INFORMATIONAL texts. This may be attributed to the relatedness of actions and states as they are viewed by the reader within STORY NARRATIVE texts. Conversely information in DESCRIPTIVE INFORMATIONAL texts may not often be viewed as a sequence of connected facts by upper elementary school readers. Recall of modifier propositions differed across content topics. Variation in recall behavior was attributed to the subjects' possible familiarity with the content topic of the TELEPHONE texts.

The influence of the STORY NARRATIVE structure in recall was indicated by the analysis of texts into hierarchical levels of propositions and a study of the level source of recall propositions. Recall from STORY NARRATIVE texts followed the patterns of information retrieval which earlier researchers had indicated. Content high in the hierarchy of text was better recalled than content low in the hierarchy.

The failure of recall from DESCRIPTIVE INFORMATIONAL texts to follow this general information retrieval pattern, was attributed to an unfamiliarity with DESCRIPTIVE INFORMATIONAL text structure.

Texts were divided into three sections, i.e., setting and theme, plot, and resolution for STORY NARRATIVE texts, and topic identification, topic expansion and conclusion statements for DESCRIPTIVE INFORMATIONAL texts. In both content topics, proportionately more was recalled from all three sections in the STORY NARRATIVE texts than in the DESCRIPTIVE INFORMATIONAL texts. The differences in recall proportions for the third section of STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts were quite noticeable. Proportionately more was recalled from the resolution sections of STORY NARRATIVE texts than the conclusion statements sections of DESCRIPTIVE INFORMATIONAL texts. However, when the definitions of sections were linked with definitions of story categories devised by Stein and Glenn (Note 18), such recall behaviors were seen to be consistent with earlier studies.

Interviews with subjects involved in the reading and recall tasks for this study yielded information about how children viewed the texts which they read. For a small group of subjects whose text differentiation was similar to the criteria used by the researcher to develop the texts, recall scores were often higher than the mean recall scores for the texts which they had read. Many subjects differentiated texts by content topic alone. When asked to state which text was better remembered, 22 out of 31 subjects chose the content topic with the STORY NARRATIVE structure. Overall the interview section of this study indicated the wide variety of sophisticated mnemonic strategies employed by readers at this level, for adequate information retrieval.

CHAPTER 6

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

The major purpose of this study was to investigate the effects of varying text structures on specific text-related variables. This was done to see if the distinctions made about the comprehension and recall behaviors of readers when reading one type of prose (i.e., simple stories) could be made when two prose types (i.e., STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL) are utilized by sixth grade proficient readers.

Associated with the major purpose was an interview study which probed children's knowledge of text structure differences and their strategies for remembering prose.

This chapter will present a brief summary of the study and outline the main findings. From these findings, conclusions will be drawn and the limitations of the study will be discussed. Implications of the study will be examined and some recommendations for further research will be made.

I. SUMMARY OF THE STUDY

The investigation of the effects of varying text structures was conducted in two stages:

Firstly, a survey was made of the science reference and textual materials used by upper elementary children. Information from this survey led to the development of texts written as examples of STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose. Pilot studies and text analyses were conducted to gauge the suitability of experimental texts.

Secondly, 32 subjects were chosen from proficient sixth grade readers (defined as proficient readers by their scores on the 77th percentile or above on the Vocabulary and Reading Comprehension subtests of the Stanford Achievement Test), in suburban public schools in Edmonton, Alberta. Each subject read and recalled two experimental texts, both immediately and after one week, and answered interview questions to assess their strategies for answering prose.

Five methods of analysis were used to investigate text structure differences. In addition, a sixth area of enquiry, the interview data, was categorized and specific relationships between statistical results arising from the first five analyses and the interview information, were inferred.

II. MAIN FINDINGS AND CONCLUSIONS

Three research questions and five null hypotheses were formulated. Data collection and analyses attempted to answer these questions and hypotheses.

Research Question 1

Do proficient sixth grade readers organize information from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose in different ways for recall tasks after reading?

Hypothesis 1.1

There will be no significant main effects or interactions between proportions of propositions recalled immediately and after one week by groups of sixth grade proficient readers when reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Significant main effects due to structure ($p < .05$ for NERVE CELLS texts; $p < .001$ for TELEPHONE texts), time of recall ($p < .001$ for both NERVE CELLS and TELEPHONE texts) and recall analysis categorization ($p \leq .001$ for both NERVE CELLS and TELEPHONE texts) were found. Significant interactions between time of recall and recall analysis categorization for both NERVE CELLS ($p \leq .001$) and TELEPHONE ($p \leq .01$) texts were found. This meant that the null hypothesis could not be accepted.

Mean recall proportions of propositions recalled from STORY NARRATIVE texts were always larger than proportions of propositions recalled from DESCRIPTIVE INFORMATIONAL texts. This suggested that the familiarity of the STORY NARRATIVE text structure enabled those who had read passages written according to this structure to read and organize information for later recall more efficiently than those who had read passages similar in content, but written according to a DESCRIPTIVE INFORMATIONAL structure.

Hypothesis 1.2

> There will be no significant main effects or interactions between proportions of propositions in the recall categories of information (i.e., text recall, text entailed recall, text evoked recall and text external recall) recalled immediately and after one week by sixth grade proficient readers after reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

A significant main effect of recall categories was found for both NERVE CELLS and TELEPHONE texts ($p \leq .001$). For the NERVE CELLS text, there was a significant interaction between time of recall and categories of recall ($p \leq .001$). This meant that the null hypothesis could not be accepted.

However, no significant main effects of text structure or time of recall were evident. Text structure was not found to interact significantly with time of recall or categories of recall. For these sixth grade proficient readers, text structure was not found to affect the proportions of propositions recalled in each recall category.

Hypothesis 1.3

> There will be no significant main effects or interactions between proportions of types of propositions (i.e., predicate, modifier, connective) recalled immediately and after one week by sixth grade proficient readers after reading STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Significant main effects were found due to text structure ($\underline{p} \leq .05$ for NERVE CELLS texts, $\underline{p} \leq .001$ for TELEPHONE texts), time of recall ($\underline{p} \leq .001$ for both NERVE CELLS and TELEPHONE texts), and types of propositions recalled ($\underline{p} \leq .001$ for both NERVE CELLS and TELEPHONE texts).

Significant interactions between text structure and types of propositions recalled were evident for both NERVE CELLS and TELEPHONE texts ($\underline{p} \leq .001$). In addition, a significant three way interaction between text structure, time of recall and types of propositions recalled was noted for NERVE CELLS texts. This meant that the null hypothesis could not be accepted.

Subjects recalled predicate and connective propositions in STORY NARRATIVE texts more frequently than they recalled them in DESCRIPTIVE INFORMATIONAL texts. This suggests that the STORY NARRATIVE text structure may convey the actions or states described in a more coherent manner for recall than the DESCRIPTIVE INFORMATIONAL text structure for proficient sixth grade readers.

Hypothesis 1.4

> There will be no significant main effects or interactions between proportions of propositions recalled at particular levels in the text hierarchy immediately and after one week by groups of sixth grade proficient readers from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Significant main effects were evident due to text structure ($p \leq .05$ for NERVE CELLS texts), time of recall ($p \leq .001$ for both NERVE CELLS and TELEPHONE texts), and hierarchical levels of information in the text ($p \leq .001$ for both NERVE CELLS and TELEPHONE texts).

Significant interactions between text structure and hierarchical levels of information in text ($p \leq .001$), and time of recall and hierarchical levels of information in text ($p \leq .01$) were evident for TELEPHONE texts. In addition, a significant interaction between text structure, time of recall and hierarchical levels of information in text was found for TELEPHONE texts ($p \leq .001$). This meant that the null hypothesis could not be accepted.

The influence of the STORY NARRATIVE text structure on recall was indicated by the analysis of texts into hierarchical levels of propositions, and a comparison of the level source of each recall proposition. Recall from STORY NARRATIVE texts followed the patterns of information retrieval which earlier researchers had indicated: content in higher levels in the hierarchy of propositions was better recalled than content low in the hierarchy.

The failure of DESCRIPTIVE INFORMATIONAL texts to follow this pattern may be attributed to unfamiliarity on subjects' behalf with the DESCRIPTIVE INFORMATIONAL text structure.

Hypothesis 1.5

> There will be no significant main effects or interactions between proportions of propositions recalled in text sections (i.e., Setting and Theme/Plot/Resolution for STORY NARRATIVE texts and Topic Identification/Topic Expansion/Conclusion Statements for DESCRIPTIVE INFORMATIONAL texts) both immediately and after one week, by groups of sixth grade proficient readers from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose.

Significant main effects were found due to text structure ($p < .001$ for NERVE CELLS texts, $p \leq .05$ for TELEPHONE texts), time of recall ($p < .001$ for NERVE CELLS and TELEPHONE texts, and template text position of propositions recalled ($p < .001$ for TELEPHONE texts).

In addition, significant interactions were evident between text structure and time of recall ($p < .05$ for both NERVE CELLS and TELEPHONE texts), and text structure, time of recall and template text position of propositions recalled for NERVE CELLS texts ($p < .001$). The lack of a significant three way interaction for TELEPHONE texts can be explained by the poor differentiation between text sections in the TELEPHONE DESCRIPTIVE INFORMATIONAL text. This meant that the null hypothesis could not be accepted.

Research Question 2

> Do sixth grade proficient readers view STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts as differing according to structure?

Many subjects differentiated texts by their content topics. Six subjects viewed STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts as differing according to structure. For these children, more of the recall scores were higher than the mean recall scores for each content and structure, than the scores obtained by the children who had differentiated texts by content.

Research Question 3

> What strategies do sixth grade proficient readers knowingly use to remember STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL prose for recall tasks after reading?

Sixth grade proficient readers engage in specific strategies to ensure adequate information retrieval. These include careful reading of text, memorization and repeated reading of text. To enhance retrieval strategies during recall, readers consciously search memory, think about text content, relate text information to prior experience and even expect that high level retrieval will be the automatic, anticipated product of reading.

III. GENERAL CONCLUSIONS

On the basis of the findings thus reported, these general conclusions are made:

1. Sixth grade proficient readers do recall proportionately different amounts of information from STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts. Mean recall proportions of propositions recalled from STORY NARRATIVE texts were always larger than mean recall proportions of propositions recalled from DESCRIPTIVE INFORMATIONAL texts.

2. Text structure does not affect the proportions of propositions recalled in specific recall categories (i.e., text recall, text entailed recall, text evoked recall, text external recall) by sixth grade proficient readers.

3. Text structure affects the proportions of types of propositions recalled from prose by sixth grade proficient readers.

4. Text structure affects the proportions of propositions recalled at specific levels in the text hierarchy by sixth grade proficient readers.

5. Text structure affects the proportions of propositions recalled from specific positions within the template text by sixth grade proficient readers.

6. Sixth grade proficient readers differentiate texts by general content, specific actions by people and text structure. Strategies used by sixth grade proficient readers to adequately retrieve text include careful text reading, rereading and memorization. When asked to recall, sixth grade proficient readers search memory, think about text content and relate text information to prior experience. Many expect high level recall to be the automatic, anticipated product of reading.

IV. LIMITATIONS

In addition to the limitations which are discussed in Chapter 1, the following limitations should be considered when interpreting the findings of this study.

1. Kintsch's method of analyzing the ideas in text is only one of several such methods. Although this study has indicated its utility in answering questions about text structure variation, several other methods may have been used for the same purpose.

2. The assignment of propositions to high, medium and low levels in the hierarchy of information from text was made in an attempt to integrate the levels into more manageable information units.

Results may have differed if Level 1 propositions had been classified as high level propositions, instead of Level 1 and Level 2 propositions, as was the assignment for this study. The present assignment was in line with other studies (i.e., DeFratis Evans, 1977), but was an arbitrary decision.

3. The experimental texts developed for this study aimed to be representative of the type of materials read by upper elementary children. However, due to the fact that they were developed specifically for this study, and according to certain criteria, the texts may not be truly representative of sixth grade science content area texts.

4. Although attempts were made to control for prior knowledge of text content topics through a pilot study, such attempts sometimes failed. Children's comments during the interview study emphasized their familiarity with the TELEPHONE content topic.

5. As stated in Chapter 2, difficulty exists in assessing what is remembered from prose by a free recall task. However probing questions during the immediate recall task would have interfered with the recall of information in the delayed recall condition.

V. IMPLICATIONS OF THIS STUDY

Text structure has been shown to be a variable which affects the comprehension and recall processes in several ways. Differing text structures affect the proportions of propositions recalled from text, the types of propositions recalled from text, the propositions recalled from specific hierarchical levels in the text, and the proportions of propositions recalled from specific positions in the template text. Implications for reading theory and the teaching of reading can be drawn from these findings.

Reading Theory

1. Differences in text structure. Most studies of comprehension and recall of discourse to date have used simple stories as stimulus materials. Findings from this study served to outline differences between STORY NARRATIVE text structure and DESCRIPTIVE INFORMATIONAL text structure. Thus, where previous reading educators had alluded to the effect of text structure on the comprehension of text (Harris & Smith, 1972; Karlin, 1975), this study has specified and elaborated on such effects.

Miller (1976), in identifying skills that are important for text comprehension, suggested that researchers needed to construct models of the text identification process. This would be done by conducting psychological studies of the conditions under which humans can identify the isomorphism of two text structures (i.e., two narratives, two problems).

Although this study did not attempt Miller's suggestion, results would indicate that subjects viewed the STORY NARRATIVE text which they read, as isomorphic to other STORY NARRATIVES they had read earlier. Implied by this is the idea the identification of DESCRIPTIVE INFORMATIONAL text and association with previously read DESCRIPTIVE INFORMATIONAL texts is a less familiar task for the sixth grade proficient reader.

Earlier studies of the comprehension and recall of text showed that competent readers recall the more general, thematic ideas from text. Recall from STORY NARRATIVE texts echoed such results. However recall of DESCRIPTIVE INFORMATIONAL propositions did not follow the patterns of information retrieval established for text recall. More details were recalled than general, main ideas suggesting that subjects may not view DESCRIPTIVE INFORMATIONAL texts as coherent entities.

This study lends support to a concept of reading comprehension as a complex of interrelated processes, one of which is text structure utilization. The degree of utilization of the structure of text for the understanding and recall of information varies with the structure of text. STORY NARRATIVE texts appear to be more easily utilized by sixth grade proficient readers, than are DESCRIPTIVE INFORMATIONAL texts.

2. Predictors of text difficulty. Another important implication of this research has been to illustrate that traditional predictors of text difficulty, such as readability measures, do not account for all of the factors which make a text easy or difficult for someone to read. All of the texts developed for this study were written at a 5-6 readability level and yet recall differences indicated that the STORY NARRATIVE texts were less difficult to read than the DESCRIPTIVE INFORMATIONAL texts in both content topics. As Kintsch and Vipond (Note 20) state:

> They (readability formulas) are concerned with word and sentence properties at a superficial level, at best, they are correlated with whatever makes a text easy or hard, but they are not the causes themselves. The problem is that the predictors commonly used do not directly reflect either the content or the organization of a text. Reading comprehension is ultimately a process of acquiring information. The nature and structure of that

> information—that is, the characteristics of the meaning of a text, as well as the processes involved in deriving this meaning from the written text—are, we assume, the real determinants of readability. That is where we must look for predictor variables, not to replace current ones, but to supplement them. (p. 12)

In short, text variables such as text structure, the number of propositions in a text base, the number of different arguments that are used in a text base, the number of times an argument is repeated in the text and the types of propositions which represent ideas in a text base can and should be used for evidence of text difficulty.

3. A proposed model of reading comprehension. Given that a variety of factors make text easy or difficult to read, Kintsch and Vipond (Note 20) have proposed a processing model of text comprehension which is summarized below:

Firstly limitations are placed on the amount of information which the reader can capably remember at one time. For this model, limits vary between four and seven information units.

Readers are presumed to chunk the text base initially into units containing six to ten propositions. Chunking is guided by syntactic structure so that sentence and phrase boundaries limit the size of information units to six to ten propositions.

From each unit, to-be-retained information is selected on the basis of importance (i.e., propositions high in the hierarchy) and recency (propositions most recently processed) for retention in short term memory.

When no connections exist between the initial text and the to-be-retained information, searches must be made in long term or semantic memory to determine whether a proposition exists which could be used to connect the initial text and the selected to-be-retained propositions. "Reinstatement searches" as they are coined by Kintsch and Vipond (1977), whether or not they are successful, "must be expected to contribute greatly to comprehension difficulty" (p. 26).

Unit-by-unit processing also results in reorganizations in the network of to-be-retained propositions as connections are made between text, to-be-retained propositions and long term memory.

Thus, the authors have postulated three sources of reading difficulty inherent in comprehending text: reorganization, reinstatement searches and the number of unconnected units. Each time a particular proposition is selected and retained in short term memory it is further processed, for instance, by being interconnected with other propositions. Each processing will increase the chances that the proposition will be successfully stored in long term memory and thus, will be recallable. Control processes, such as the reader's purpose and the use of background knowledge in acquiring new information, are noted as crucial components of the total process in the proposed model (Kintsch & Vipond, Note 20, pp. 24-27).

Results from this study show that the structure of the text will delimit further the processing undertaken by the reader. To-be-retained propositions are selected on the basis not only of importance and recency, but also on the basis of the type of information they convey within a particular text structure. Hence, within STORY NARRATIVE texts, proportionately more predicate and connective propositions are recalled (and presumably selected) than modifier propositions.

Reinstatement searches are attempts to connect the initial text and the selected to-be-remembered propositions, by searching long term memory. Long term memory includes knowledge of particular text structure types. This study has shown that knowledge and utilization of a DESCRIPTIVE INFORMATIONAL text is more difficult than the utilization of a STORY NARRATIVE text. Thus, it is proposed that the three sources of reading difficulty inherent in comprehending text as indicated by Kintsch and Vipond (Note 20): reorganization, reinstatement searches and the number of unconnected units, are themselves dependent on the structure of the text by which the information is conveyed. If a text structure is one with which the reader is familiar, reinstatement searches, and reorganization of the to-be-remembered propositions will be made in terms of "goodness of fit" with a known text structure. Unconnected units would be more likely not to be recalled if they lacked linkage within the known text structure or would be recalled if, as Meyer (1977) has found with the recall of information at low levels in the content structure of text, they represent "particularities of the content, striking qualities such as familiar proper names and numbers" (p. 330). Research is needed to gauge the effects of specified text structures developmentally, and within specific interest areas.

The Teaching of Reading

The importance of the text structure variable for teaching, testing and writing will be outlined below.

1. Teaching reading. Responses to the interview section of this study suggest that sixth grade proficient readers are more able

to read and remember information from STORY NARRATIVE texts than from DESCRIPTIVE INFORMATIONAL texts. Interview responses also indicated that these readers prefer to read information conveyed by a STORY NARRATIVE text structure more so than information conveyed by a DESCRIPTIVE INFORMATIONAL text structure.

This preferred structure may be attributed to the age of the subjects and their limited exposure to various text structures while reading. However, children at this level need to become familiar, at least with DESCRIPTIVE INFORMATIONAL prose to allow them to read and comprehend many of the texts prescribed at junior high and high school levels. Meyer (Note 21) has suggested that training programs should be designed to help readers to identify and utilize text structure. An experiment by Meyer, Brandt and Bluth (Note 6) showed that for less able readers, signals within the text such as paragraph headings and topic sentences facilitated recall. Further research is needed to see just which types of facilitators enable readers to recognize and utilize the structure of text most efficiently.

Familiarity with the DESCRIPTIVE INFORMATIONAL text structure needs to be developed, firstly by more detailed study of what constitutes a DESCRIPTIVE INFORMATIONAL text, and secondly by giving children opportunities to read many different DESCRIPTIVE INFORMATIONAL texts and to discuss the parts of the text which constitute the whole.

2. Testing of reading. Where recall tasks are involved in the evaluation of a reader's comprehension of text, one needs to take account of the structure of text. In some standardized reading tests, where STORY NARRATIVE and DESCRIPTIVE INFORMATIONAL texts are inter-

mingled, no recognition is given to the effect of text structure on comprehension and recall. Results from this study suggest that in evaluating a child's ability to read and comprehend, text structure is an important variable. One way of evaluating text structure utilization would be to develop tests with several texts differing in structure, and yet at the same level of difficulty, in terms of proposition density and repetition, as well as readability level.

A delineation of the structure of a text also enables the development of a series of questions which entail content, but check on comprehension and recall of information from specific text positions. Questions could be asked about specifics such as are outlined in a story grammar or a delineation of DESCRIPTIVE INFORMATIONAL text. This would be yet another way to evaluate text structure utilization. In addition it allows for similar types of questions to be asked of different texts. Such questions could also be used to enable students to recognize specific structures. As Kintsch and Vipond (Note 20) have commented:

> Asking questions is meaningful only if we have a fairly precise theory of text structure and text processing, and if we know the role of the information tapped by our questions in terms of the total structure and process. (p. 14)

3. Writing for children's texts. Writers of children's texts need to provide well organized information with clearly identifiable text structures. It should be realized that some text structures are more effective than others when the tasks of comprehending and recalling information are at hand.

Studies by Stein and Glenn (Note 22) have indicated that children's knowledge of text structures is evident to the extent that they are utilized in the writing which children do. More research is needed to discover the similarities and differences in the effect of text structure on reading and writing tasks.

VI. SUGGESTIONS FOR FURTHER RESEARCH

1. A descriptive informational grammar. This study had demonstrated the relevance of the analysis tools developed by Kintsch (1974), Rumelhart (1975) and Drum and Lantaff (Note 16) for research into differential discourse processes. More detailed study of what constitutes a DESCRIPTIVE INFORMATIONAL text structure will enable researchers to adequately explore the relationships between comprehension and recall processes and this particular text structure.

2. Propositions recalled from specific text positions. The notion of what is remembered from particular positions in the template text is of importance to the study of discourse processes (Kintsch & Kozminsky, 1977; Mandler & Johnson, 1977; Stein & Nezworski, Note 18). These specific positions need to be well defined. Whether the divisions are made so that an equal number of words is found in each section (Kintsch & Kozminsky, 1977), or they are made to conform with specific rewrite rules for text (Stein & Glenn, 1977) will affect the results of the enquiry.

3. Interview studies. More extensive use should be made of the interview techniques utilized in this study. Children obviously have many sophisticated strategies for reading and remembering texts, and while many of these behaviors may not be consciously undertaken,

questions and tasks may be devised to adequately infer their use.

4. Assessing what is remembered from text. A detailed study of the relative efficiency of ways of assessing what is recalled from text needs to be undertaken. Free recall tasks have been found to be an underestimate of what is remembered after reading.

5. External recall: What is its purpose? External recall was an important part of each child's recall of text. As yet, no studies have been made of what constitutes specific external utterances. A study of external recall in texts differing by structure may provide additional knowledge about the text structure variable, and its relationship to other variables affecting comprehension and recall of text.

6. Utilization of text structure. Research is needed to see how people identify text structures. Developmental studies of when readers at different levels and ages use differing text structures most efficiently are also needed.

7. Most research needs outlined here are dependent on specifications of differential text structures within the world of prose. Models of what constitutes prose differences have been proposed (e.g., Bereiter, Note 17). Such models need to be tested in behavioral terms to see if purported text difficulties are inferable from students' text recall behaviors.

VII. CONCLUDING STATEMENT

The evidence provided by the findings of this study suggests that the variable of text structure plays a considerable role in the comprehension and recall of information from text. DESCRIPTIVE INFORMATIONAL texts provide proficient sixth grade readers with considerable difficulty when reading and recalling information. A more detailed explanation of what constitutes a DESCRIPTIVE INFORMATIONAL text and instruction in this is needed in the upper elementary grades.

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APPENDICES

APPENDIX A

PROPOSITIONAL ANALYSIS MANUAL PREPARED FOR INTERJUDGE RELIABILITY RATINGS

CONSTRUCTING AND USING A PROPOSITIONAL TEXT BASE

Theory

The meaning of a text is assumed to be represented by a list of connected propositions. This proposition list is called a text base. Propositions are groups of word concepts, one serving as a relation, the others as arguments of the propositions. Propositions are idea units, each one representing a single idea.

Propositions can be divided into three classes depending on the type of relation they contain: predicate, modifier or connective.

Predicate propositions. Predicate propositions express ideas of actions (sentences 1 and 2 below), and states (sentence 3 and 4 below). The relation of a predicate proposition is usually a verb. Included as predicate propositions are nominal propositions which express set membership (sentences 5 and 6 below), and referential propositions which state that the referent of one argument is the same as that of a second argument (sentences 7 and 8 below). Reference positions are used to indicate references outside sentence boundaries, although they are hardly ever used to reference arguments in adjacent sentences where the meaning of the reference is clearly stated.

I.e., In a nerve cell there is a neuron. It has many tiny branches.

P1 (EXIST, NEURON)
P2 (Loc:IN, A1*: P1*, NERVE CELL)
P3 (POSSESS, P1, BRANCHES)
P4 (QUALITY OF, BRANCHES, TINY)
P5 (NUMBER OF, BRANCHES, MANY)

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*A1 = Argument 1; P1 = Proposition 1.

"It" in the second sentence refers to the neuron. Because of its proximity to the referent, a reference proposition, viz. (REFERENCE, IT, NEURON) was deemed to be necessary.

Example Sentences

1. Michael Faraday made electricity with a magnet.

   (MAKE, A* : MICHAEL FARADAY, I:MAGNET, O:ELECTRICITY)

2. Sounds are caused by vibrations.

   (CAUSE, A:$, I:VIBRATIONS, O:SOUNDS)

3. Bell felt helpless.

   (FEEL, E:BELL, I:HELPLESS)

4. A neuron has branches.

   (POSSESS, A:NEURON, O:BRANCHES)

5. Golgi was a doctor.

   (ISA, GOLGI, DOCTOR)

6. Alexander Graham Bell was a professor.

   (ISA, ALEXANDER GRAHAM BELL, PROFESSOR)

7. The subjects were old women . . . The participants came each day . . . The senior citizens gave their views.

   1. (REFERENCE, PARTICIPANTS, SUBJECTS)

   2. (REFERENCE, SENIOR CITIZENS, 1)

8. Telly Savalas is Kojak.

   (REFERENCE, TELLY SAVALAS, KOJAK)

The use of "is" and "have"

The verbs "to have" and "to be" can be used as auxiliary verbs to form a number of tenses from other verbs. Propositions do not have tenses. Tenses are assumed to be a product of the syntax of the language expressing distinctions in time. These distinctions are derived from contextual information or time references given in the surface text. "Have" and "is" are not used in propositions. When the verb "to have" is used with semantic intent, relations such as "POSSESS," "QUALITY OF" or "PART OF" are used.

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* A etc. See section on Predicate Propositions and Case Relations.

Example Sentences

1. Bill has a pen.
   (POSSESS, BILL, PEN)
2. A car has a bumper.
   (PART OF, CAR, BUMPER)
3. John has to go to Calgary.
   (QUALIFY (GO, A:JOHN, G: CALGARY) NECESSARY)

When the verb "to be" is used with semantic intent, relations such as "REFERENCE," "ISA" and "QUALITY OF" are used.

Example Sentences

1. The dog Jim found was a Dalmatian.
   (REFERENCE, DALMATIAN, (FIND, JIM, DOG))
2. Monday is a holiday.
   (ISA, MONDAY, HOLIDAY)
3. Henry is thirsty.
   (QUALITY OF, HENRY, THIRSTY)

Predicate propositions and case relations

Each argument of a proposition stands in a special relationship to the relation of the proposition. Fillmore's case grammar

(Fillmore, 1969) has been used by Kintsch (1974) to classify the arguments of propositions according to their relationship to the relation of a predicate proposition, when the relation is a verb. The following case relationships are defined and represented by category symbols to show the role or case assumed by specific arguments in a proposition in relationship to the verb.

1. Agent (A) - typically animate instigator of the state or action identified by the verb.
2. Experience (E) - experience of a psychological event.
3. Instrument (I) - typically inanimate stimulus of an experience, a force or object causally involved in the state or action identified by the verb.
4. Object (O) - object of an action which undergoes change or movement.
5. Source (S) - source or state or action identified by the verb.
6. Goal (G) - result or goal of state or action identified by the verb.

These case relations are usually used with verbs of motion (e.g., go, flow).

In the sentence:

Michael Faraday made electricity with a magnet

(MAKE, A:MICHAEL FARADAY, I:MAGNET, O:ELECTRICITY)

each argument assumes a different role in relation to the verb "make." Michael Faraday is the agent, magnet is the instrument and electricity is the object.

If a verb requires that a certain case be present but it is absent from the surface structure of the sentence, then an empty case marker ($) must be inserted. For example:

The news was given.

(GIVE, A:$, O:NEWS)

The verb "give" requires an agent. Since the case is empty in this sentence, an empty case marker is used to fill the agent slot.

Modifier propositions. Modifier propositions change a concept by restricting it or limiting it by means of another idea. *Negation* is a type of modifier which expresses the complement of a stative proposition. *Qualifier* propositions are Modifier propositions which express a quality or attribute of a proposition. *Quantifier* propositions are Modifier propositions which express either the extent of an entity, or a definite or indefinite quantity. Partitive propositions are Modifier propositions which indicate a part of a collective whole. The following are examples of Modifier propositions.

1. All sounds are caused by vibrations.
    (CAUSE, A:VIBRATIONS, O:SOUNDS) Predicate proposition
    (NUMBER OF, SOUNDS, ALL) Quantifier proposition
2. A neuron has tiny branches.
    (POSSESS, A:NEURON, O:BRANCHES) Predicate proposition
    (QUALITY OF, BRANCHES, TINY) Qualifier proposition
3. The branches don't join.
    1. (JOIN, A:BRANCHES) Predicate proposition
    2. (NEGATE, 1) Negative proposition

4. A neuron is part of a cell.

1. (EXIST, CELL)	Predicate proposition
2. (PART OF, 1, NEURON)	Partitive proposition

Connective propositions. These propositions relate propositions in the text to each other and provide text cohesion. Often, connective propositions are unexpressed in the text and then must be inferred. There are eight types of connective propositions.

1. Conjunction expressing and, also, along with, in addition to.
2. Disjunction expressing or, and/or, either/or.
3. Causality expressing because, by, therefore, thus.
4. Purpose expressing in order to, to, for.
5. Concession expressing but, although, however.
6. Contrast expressing greater than, different from, equal to or same as, close to or similar to.
7. Condition expressing if . . . then.
8. Circumstance expressing a. Time: a temporal reference point
    : another event
    b. Location
    c. Manner.

Propositions of manner often specify the particular way in which an argument occurs by a prepositional phrase using "with" or by an adverb. These propositions can be expressed using the proposition of qualification. For example:

Tom swam with speed.

1. (SWIM, TOM)
2. (MANNER:WITH, A1:1, A2:SPEED)

or

1. (SWIM, TOM)
2. (QUALIFY, A1:1, A2:SPEEDILY)

Relations and the Construction of Propositions

Relations fall into three major classes:

PREDICATION

VERB - relationship of action or state

ISA - set membership

REFERENCE - referent of one argument is the same as that of the second argument

MODIFICATION

QUALIFIER

Adjectival - quality of
Adverbial - qualify, delimit
Hedge - make fuzzy or less fuzzy.

(QUALIFY, A1, A2) where the argument A1 is limited or altered by the argument A2.

(QUALITY OF, A1, A2) where the argument A1 has a certain quality namely A2.

QUANTIFIER

(NUMBER OF, A1, A2) where A2 specifies the number, whether definite or indefinite, of the argument A1.

(EXTENT OF, A1, A2) where the argument A1 is the whole entity being quantified and A2 is its quantifier.

CONNECTION

CONJUNCTION

(CONJUNCTION:Relation, A1, A2) where the list of arguments is connected in the manner indicated by the relation.

(Conjunction relations include: and, in addition to, also, along with.)

DISJUNCTION

(DISJUNCTION:Relation, A1, A2) where the list of arguments are alternatives.

(Disjunctive relations: or, and/or, either or.)

CAUSALITY

(CAUSALITY:Relation, A1, A2, [A3] where A1 is the causal agent or event, A2 is the effect or consequence of A1, and A3 [if present] is the instrument of the causal relationship.

(Causal relations: because, by, therefore, thus.)

PREDICATION

MODIFICATION

PARTITIVE

(PART OF, A1, A2) where A1 is a composite unit which has as one of its parts A2.

(SOME OF, A1, A2) where the argument A1 is a set of units, while the argument A2 is a subset of the set A1.

NEGATION

(NEGATE, A1) where A1 is always a proposition.

CONNECTION

PURPOSE

(PURPOSE:Relation, A1, A2) where A1 indicates the act or event which is directed at the fulfilment of the intention and A2 indicates the act or event which is the intended outcome or result.

(Purpose relations: in order to, for the purpose of, to, for, that, so.)

CONCESSION

(CONCESSION:Relation, A1, A2) where A1 is an argument which does not prevent the argument A2.

(Concession relations: but, although, while, however, yet.)

CONTRAST

(CONTRAST:Relation, A1, A2) where A1 is related to A2 by the specified relation.

(Contrast relations: greater than, different from, equal to, same as, close to, similar to, far from, etc.)

CONDITION

(CONDITION:Relation, A1, A2) where A1 is a condition for the occurrence of A2 in the manner specified by the relation, or where A1 is a restriction or qualification

PREDICATION	MODIFICATION	CONNECTION
		placed on the occurrence or character of A2 as specified by the relation. (Condition relations: if . . . then, if, unless, unless . . . not, except.) CIRCUMSTANCE (TIME:Relation, A1, A2) where A1 occurs in a specified relation to A2. A2 may be a temporal reference point, such as a date, or another event. (Time relations: yet, from now on, always, simultaneously, continuously, momentarily, long before, eventually, never, intermittently.) (LOCATION:Relation, A1, A2) where A1 is in the specified relationship to A2. A2 is generally an object or location, while A1 could also be a proposition. (Location relations: usually prepositions.) (MANNER:Relation, A1, A2) where A1 is a proposition which proceeds in the manner A2, as prescribed by the relation. (Manner relations: as, like, likewise, so.)

Levels of Propositions

In diagramming a text base, each proposition is written on a separate line and numbered for easy reference. Each text base has one (or more) thematic proposition(s). These are Level 1 propositions or the better-ordered ones. A propositional hierarchy can be devised by considering the repetition of arguments between propositions. All propositions introducing new arguments into the text are "superordinate," or Level 1 propositions. "Subordinate" propositions repeat the arguments of higher level propositions. I.e., All propositions repeating an argument of a Level 1 proposition are directly subordinated to Level 1 propositions and form the group of Level 2 propositions. All propositions sharing an argument with one of the Level 2 propositions, but not with a Level 1 proposition, form the Level 3 propositions (Kintsch, Note 1; Kintsch & van Dijk, 1976).

Thus, the following text excerpt would be diagrammed in the following way:

> "A nerve cell is very tiny and a microscope is needed to study it. In a nerve cell there is a neuron. It has many tiny branches."

List of Propositions	Level					
	1	2	3	4	5	6
1.	(EXIST, A:CELL)					
2.		(QUALITY OF, CELL, NERVE)				
3.			(QUALITY OF, 2, TINY)			
4.				(QUALIFY, 3, VERY)		
5.	(NEED, A:$, O:MICROSCOPE)					
6.			(STUDY, A:$, O:2)			
7.		(PURPOSE:TO, A1:5, A2:6)				
8.			(CONJ:AND, 4, 7)			
9.	(EXIST, A:NEURON)					
10.		(LOCATION:IN, A1:9, A2:2)				
11.		(POSSESS, A:9, O:BRANCHES)				
12.			(QUALITY OF, 11, TINY)			
13.			(QUANTITY OF, 11, MANY)			

APPENDIX B

INITIAL PASSAGES DEVELOPED FOR EXPERIMENTAL TASKS

i. STORY NARRATIVE Forms
ii. DESCRIPTIVE INFORMATIONAL Forms
iii. Instruction Sheet for Pilot Study One
iv. Experimental Texts

i. STORY NARRATIVE FORMS

WHAT MAKES LIGHT IN A LIGHT BULB?

Thomas Edison sold newspapers in Southern Ontario. Later, he became a successful inventor. The phonograph was one of his inventions. He used electricity to make light in 1879.

A light bulb glows because the wire inside it gets hot when electricity flows through it. We call the wire a filament. Edison spent two years searching for a filament which would not burn away. Finally he used carbonized thread. This was sewing thread burned to an ash. The gases in a light bulb don't burn. They help keep the filament from burning away.

In October, 1879, Edison managed to place a filament of carbonized thread in a light bulb. The bulb glowed brightly for two days.

HOW DO YOU GET ELECTRICITY FROM A MAGNET?

Michael Faraday became a well-known scientist in England. In 1831 he made electricity using a magnet.

He dropped iron filings onto paper, under which he had placed a magnet. The iron formed lines. Faraday called the lines, lines of force. He knew also, that magnetic force lies around any wire carrying electricity.

Faraday made a spring of wire which he joined in a machine for measuring electricity. When a magnet was pushed in and out of the wire spring, or the wire spring was moved over the magnet, the machine showed there was electricity in the wire.

In both cases, the magnetic lines of force of the magnet were cut by the wire. When the wire and the magnet were held still, no electricity flowed. This discovery was to make Faraday very well-known.

NERVE CELLS

Camillo Golgi was an Italian doctor. He was interested in studying cells and tissues, and the structure of the nervous system. Until this time no one really knew what a nerve cell looked like.

In 1873 Golgi found a way of staining nerve cells with silver salts. Then he could study them with a microscope. He could see details of the nerve cell that others had not seen before. Golgi was the first person to see that a nerve cell has parts which we still call Golgi bodies. He also discovered that the neuron in a nerve cell has tiny branches. Other doctors thought that the branches in one nerve cell joined the branches in different nerve cells. Golgi found that they don't really join at all. They leave tiny gaps called synapses.

Golgi was awarded a Nobel Prize in 1906 for the work he did on the structure of the nervous system.

HOW BATS LOCATE FOOD

Bats have poor eyesight and fly mostly at night. For years people wondered how bats located food.

In 1793, a scientist in Italy blinded some bats and set them free. He later caught them again. These bats had as many insects in their stomachs as bats which had not been blinded. He plugged their ears. This made them bump into things. They couldn't catch food.

One hundred and forty-five years later, in 1938, an American scientist named Griffin discovered why. Griffin found that bats give off noises at a higher pitch than the human ear can hear. When these noises hit an object, they bounce back. The bat hears the echo and knows something is in its way. It uses the noises to find food and other objects. This system is called echo-location.

HOW DOES A TELEPHONE WORK?

Alexander Graham Bell was a professor at Boston University. He experimented with electricity. In 1876 he discovered a way to carry the voice using electricity.

Bell made a transmitter from a thin sheet of metal. Behind the metal was a box with grains of sand in it. Electricity ran through the sand. Voice sounds made the metal vibrate. This, then, made the sand grains wiggle. Then different amounts of electricity could flow through a wire to a receiver. The different amounts of electricity were copies of different voice sounds.

Bell also made a receiver with a thin sheet of metal. The different amounts of electricity made an electromagnet pull the sheet of metal towards it. The sheet vibrated and Bell heard voice sounds. Bell's first telephone words were a cry of help. He had spilled acid over his clothes.

ii. DESCRIPTIVE INFORMATIONAL FORMS

WHAT MAKES LIGHT IN A LIGHT BULB?

When you flip a light switch, electricity zips through the cord to the lamp, into the bulb and up into a coil of wire. The wire glows white hot.

The wire is called a filament. Today that wire is made from tungsten. Early light bulbs used carbonized sewing thread. This was sewing thread which had been burned to an ash. However light bulbs did not last as long as they do today.

Inside the light bulb are gases. These gases don't burn. They are not like the gas in a kitchen stove. They help keep the filament from burning away. In this way the light will shine for a long time.

HOW DO YOU GET ELECTRICITY FROM A MAGNET?

If a magnet is held under a piece of paper and iron filings are dropped onto the paper, they will form lines. These lines show the magnet's lines of force. All of the lines of force make up the magnetic field. A magnetic field is also around any wire carrying electricity.

When a magnet is pushed in and out of a wire spring, or a wire spring is moved over a magnet, the same thing happens. Electricity flows through the wire. This can be shown by joining the wire to a machine which measures electricity flow. Either way the wire cuts the magnetic field of the magnet. When both magnet and wire are held still, no electricity flows. The magnetic field is not being cut. To keep electricity flowing, both need to keep moving.

NERVE CELLS

A nerve cell is very tiny and a microscope is need to study it. In a nerve cell there is a neuron. It has many tiny branches. Early doctors thought that the tiny branches in one nerve cell joined the tiny branches in different nerve cells. A way of staining nerve cells with silver salts helped doctors to see nerve cells in clear detail. It also helped them change their minds.

Until silver salts were used to stain nerve cells, there was no way of knowing what a nerve cell looked like. Now doctors know that the branches in different nerve cells don't really join at all. They leave tiny gaps called synapses. As well, parts of the nerve cell, called Golgi bodies, were discovered because of staining. Knowing about nerve cells has helped scientists to know more about the structure of the nervous system.

HOW BATS LOCATE FOOD

Bats have poor eyesight and they fly mostly at night. For hundreds of years people wondered how bats located their food.

Many different experiments which deprived bats of the uses of their senses were performed. Bats were blinded but they still could find food. Only when that bats' ears were plugged and they could not hear, they could not catch food. Then scientists listened to bats with a special machine.

It was discovered that bats give off noises at a higher pitch than the human ear can hear. If these bat noises hit an object and bounce back, the bat hears the echo. It uses the noises to find food and other objects. This system is called echo-location.

HOW DOES A TELEPHONE WORK?

All sounds are caused by vibrations. Electricity helps vibrations to travel quickly over many miles. Telephones carry a person's voice using vibrations and electricity.

A telephone transmitter is a thin sheet of metal. Voice sounds make the metal vibrate. As it bends back, the metal pushes against a box full of carbon grains. This makes the carbon wiggle. Then, different amounts of electricity can flow through the electric wire to a receiver. The different amounts of electricity are copies of the different sounds of your voice.

The receiver also has a thin sheet of metal. The electricity in different amounts makes an electro-magnet pull the sheet towards itself. The metal sheet bends and makes another copy of voice sounds. The person you are talking to hears this copy of the sounds of your voice.

iii. INSTRUCTION SHEET WHICH ACCOMPANIED EACH SET OF PASSAGES, I.E., STORY NARRATIVE OR DESCRIPTIVE INFORMATIONAL

Can you tell me which stories YOU know most about?

The following pages contain 5 short stories dealing with 5 different topics. Please read each story. Then decide which story you know most about. Give a score of $\boxed{1}$. Decide which story you know almost as much about. Give it a score of $\boxed{2}$. Keep scoring until you come to the story you know very little about at all. Give it a score of $\boxed{5}$. Thank you for your time.

FILL-IN SHEET FOR RATING STORIES

Boy/Girl (Circle)   Age ______________   Grade ____________

How Bats Locate Food ☐

Nerve Cells ☐

How Does a Telephone Work? ☐

How do you Get Electricity from a Magnet? ☐

What makes Light in a Light Bulb? ☐

iv. EXPERIMENTAL TEXTS USED IN THE MAIN STUDY

a. NERVE CELLS - STORY NARRATIVE Form

Camillo Golgi was an Italian doctor. He was interested in studying cells and tissues, and the structure of the nervous system. Until this time no one really knew what a nerve cell looked like.

In 1873, Golgi found a way of staining nerve cells with silver salts. Then he could study them with a microscope. He could see details of the nerve cell that others had not seen before. Golgi was the first person to see that a nerve cell has parts which we still call Golgi Bodies. He also discovered that the neuron in a nerve cell has tiny branches. Other doctors thought that the branches in one nerve cell joined the branches in different nerve cells. Golgi found that they don't really join at all. They leave tiny gaps called synapses.

Golgi was awarded a Nobel Prize in 1906, for the work he did on the structure of the nervous system.

b. NERVE CELLS - DESCRIPTIVE INFORMATIONAL Form

A nerve cell is very tiny and a microscope is needed to study it. In a nerve cell there is a neuron. It has many tiny branches. Early doctors thought that the tiny branches in one nerve cell joined the tiny branches in different nerve cells. A way of staining nerve cells with silver salts, helped doctors to see nerve cells in clear detail. It also helped them change their minds.

Until silver salts were used to stain nerve cells, there was no way of knowing what a nerve cell looked like. Now doctors know that the branches in different nerve cells don't really join at all. They leave tiny gaps called synapses. As well, parts of the nerve cell, called Golgi Bodies, were discovered because of staining. Knowing about nerve cells has helped scientists to know more about the structure of the nervous system.

c. TELEPHONE - STORY NARRATIVE Form

Alexander Graham Bell was a professor at Boston University. He experimented with electricity. In 1876, he found a way to carry the voice using electricity.

Bell made a transmitter from a thin sheet of metal. Behind the metal was a box with grains of sand in it. Electricity ran through the sand. Voice sounds made the metal vibrate. This, then, made the sand grains wiggle. Then different amounts of electricity could flow through a wire to a receiver. The different amounts of electricity were copies of different voice sounds.

Bell also made a receiver with a thin sheet of metal. The different amounts of electricity made an electromagnet pull the sheet of metal towards itself. The sheet vibrated and Bell heard voice sounds. Bell's first telephone words were a cry of help. He had spilled acid over his clothes.

d. TELEPHONE - DESCRIPTIVE INFORMATIONAL Form

All sounds are caused by vibrations. Electricity helps vibrations to travel quickly over many miles. Telephones carry a person's voice using vibrations and electricity.

A telephone transmitter is a thin sheet of metal. Voice sounds make the metal vibrate. As it bends back, the metal pushes against a box full of carbon grains. This makes the carbon wiggle. Then, different amounts of electricity can flow through the electric wire to a receiver. The different amounts of electricity are copies of the different sounds of your voice.

The receiver also has a thin sheet of metal. The electricity in different amounts makes an electromagnet pull the sheet towards itself. The metal sheet bends and makes another copy of voice sounds. The person you are talking to hears this copy of the sounds of your voice.

APPENDIX C

EXAMPLES OF CLOZE TESTS USED IN PILOT STUDY THREE

INSTRUCTIONS

Name ____________________ School ____________________

These pages contain two passages, from which every fifth word has been taken out, and blanks have been put in. You are to guess which word has been taken out, and write that word in the blank.

An example:

In Spring the __________ will melt.

You will probably guess that "snow" has been taken out.

You would write the word in the blank like this.

In Spring the snow will melt.

Remember

1. All blanks are exactly the same length but the words that go in them may be long or short.
2. Write only ONE word in each blank.
3. Try to fill every blank and don't be afraid to guess.
4. The word taken out might be a number like 1984.

   It might be a contraction like isn't.

   It might be someone's name like Jill.

   It might be a hyphenated word like semi-trailer.

   Most words are common words.

Camillo Golgi ____________ an Italian doctor. He ____________ interested in studying cells ____________ tissues, and the structure ____________ the nervous system. Until ____________ time no one really ____________ what a nerve cell ____________ like.

In 1873 Golgi ____________ a way of staining ____________ cells with silver salts. ____________ he could study them ____________ a microscope. He could ____________ details of the nerve ____________ that others had not ____________ before. Golgi was the ____________ person to see that ____________ nerve cell has parts ____________ we still call Golgi ____________. He also discovered that ____________ neuron in a nerve ____________ has tiny branches. Other ____________ thought that the branches ____________ one nerve cell joined ____________ branches in different nerve ____________. Golgi found that they ____________ really join at all. ____________ leave tiny gaps called ____________.

Golgi was awarded a ____________ Prize in 1906 for ____________ word he did on ____________ structure of the nervous ____________.

All sounds ____________ caused by vibrations. Electricity ____________ vibrations to travel quickly ____________ many miles. Telephones carry ____________ person's voice using vibrations ____________ electricity.

A telephone transmitter ____________ a thin sheet of ____________. Voice sounds make the ____________ vibrate. As it bends ____________, the metal pushes against ____________ box full of carbon ____________. This makes the carbon ____________. Then, different amounts of ____________ can flow through the ____________ wire to a receiver. ____________ different amounts of electricity ____________ copies of the different ____________ of your voice.

The ____________ also has a thin ____________ of metal. The electricity ____________ different amounts makes an ____________ pull the sheet towards ____________. The metal sheet bends ____________ makes another copy of ____________ sounds. The person you ____________ talking to hears this ____________ of the sounds of ____________ voice.

APPENDIX D

TEXT ANALYSES FOR PASSAGES USED IN EXPERIMENTAL TASKS AND SCORING SHEETS

i. NERVE CELLS STORY NARRATIVE Worksheet

ii. NERVE CELLS DESCRIPTIVE INFORMATIONAL Worksheet

iii. TELEPHONE STORY NARRATIVE Worksheet

iv. TELEPHONE DESCRIPTIVE INFORMATIONAL Worksheet

v. Example of score sheet for recall proportions, types of propositions, levels in text hierarchy of propositions and position of recall propositions in template text

i. NERVE CELLS STORY NARRATIVE Text Worksheet

NERVE CELLS - STORY NARRATIVE TEXT

1 2 3 4 5 6

P 1. (ISA, CAMILLO GOLGI, DOCTOR)
M 2. (QUALIFY, DOCTOR, ITALIAN)
P 3. (POSSESS, 1, INTEREST)
P 4. (EXIST, NERVOUS SYSTEM)
C 5. (CONJUNCTION: AND, CELLS, TISSUES, STRUCTURES)
M 6. (PART OF, 4, 5)
P 7. (STUDY, 1, 6)
C 8. (PURPOSE: TO, 3, 7)
P 9. (KNOW, NO ONE, APPEARANCE)
P 10. (POSSESS, CELL, APPEARANCE)
M 11. (QUALIFY, CELL, NERVE)
M 12. (QUALIFY, 9, REALLY)
P 13. (REFERENCE, 8, TIME)
C 14. (TIME: UNTIL, 9, 13)
P 15. (FIND, 1, WAY)
P 16. (STAIN, 1, I: SALTS, CELLS)
M 17. (QUALIFY, CELLS, NERVE)
M 18. (QUALIFY, SALTS, SILVER)
C 19. (PURPOSE: TO, 15, 16)
C 20. (TIME: IN, 19, 1873)
P 21. (STUDY, 1, I: MICROSCOPE, 19)
C 22. (CAUSALITY: THEN, 19, 21)
P 23. (SEE, 1, DETAILS)
P 24. (POSSESS, 11, DETAILS)
P 25. (SEE, OTHERS, 24)
M 26. (NEGATE, 25)
M 27. (QUALIFY, 26, BEFORE)
P 28. (REFERENCE, 1, PERSON)
M 29. (QUALIFY, PERSON, FIRST)
P 30. (POSSESS, 11, PARTS)
P 31. (REFERENCE, PARTS, GOLGI BODIES)
M 32. (QUALIFY, 31, STILL)
P 33. (SEE, 29, 30)
P 34. (DISCOVER, 1, 37)
P 35. (EXIST, NEURON)
C 36. (LOC: IN, 35, 11)
P 37. (POSSESS, 36, BRANCHES)
M 38. (QUALITY OF, BRANCHES, TINY)
C 39. (CONJUNCTION: ALSO, 38, 34)

READING TIME ______ SECS

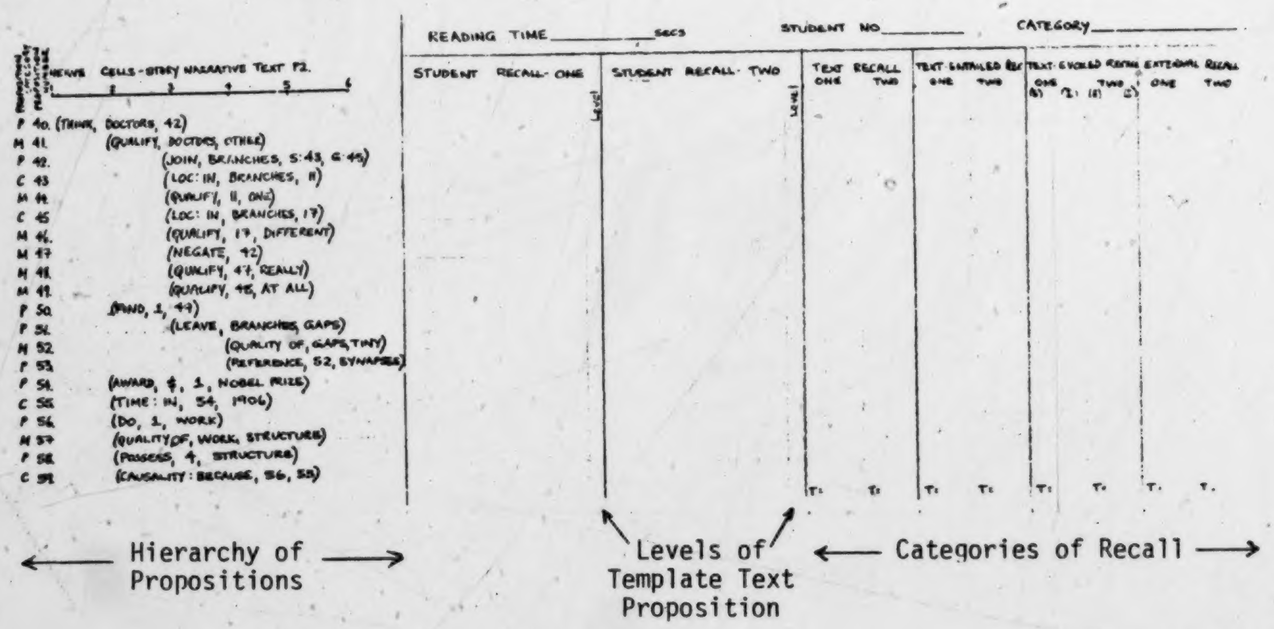
STUDENT NO. ______ CATEGORY ______

STUDENT RECALL · ONE	Level	STUDENT RECALL · TWO	Level	TEXT ONE	RECALL TWO	TEXT ENTAILED RECALL ONE	TWO	TEXT-EVOKED RECALL ONE	TWO	EXTERNAL RECALL ONE	TWO
				T.	T.	T.	T.	T.	T.	T.	T.

← Hierarchy of Propositions →

Levels of Template Text Proposition

← Categories of Recall →



NERVE CELLS - STORY NARRATIVE TEXT F2.

1 2 3 4 5 6

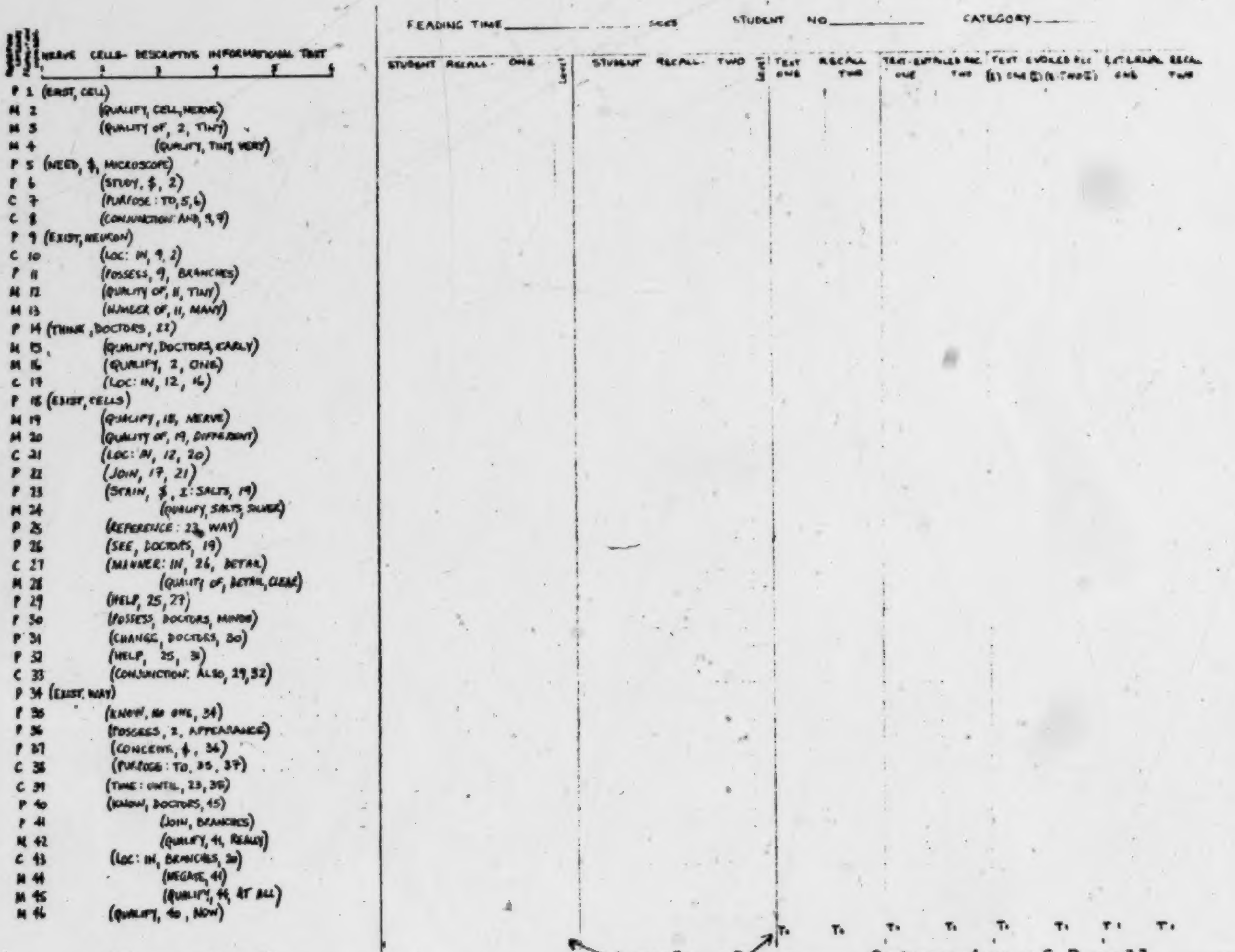
P 40. (THINK, DOCTORS, 42)
M 41. (QUALIFY, DOCTORS, OTHER)
P 42. (JOIN, BRANCHES, 5:43, 6:45)
C 43 (LOC: IN, BRANCHES, 11)
M 44. (QUALIFY, 11, ONE)
C 45 (LOC: IN, BRANCHES, 17)
M 46. (QUALIFY, 17, DIFFERENT)
M 47 (NEGATE, 42)
M 48. (QUALIFY, 47, REALLY)
M 49. (QUALIFY, 45, AT ALL)
P 50. (FIND, 1, 49)
P 51. (LEAVE, BRANCHES, GAPS)
M 52 (QUALITY OF, GAPS, TINY)
P 53 (REFERENCE, 52, SYNAPSES)
P 54. (AWARD, $, 1, NOBEL PRIZE)
C 55 (TIME: IN, 54, 1906)
P 56. (DO, 1, WORK)
M 57 (QUALITY OF, WORK, STRUCTURE)
P 58. (POSSESS, 4, STRUCTURE)
C 59 (CAUSALITY: BECAUSE, 56, 55)

READING TIME __________ SECS STUDENT NO ________ CATEGORY ______________

STUDENT RECALL - ONE	LEVEL	STUDENT RECALL - TWO	LEVEL	TEXT RECALL ONE	TEXT RECALL TWO	TEXT ENTAILED REC ONE	TEXT ENTAILED REC TWO	TEXT EVOKED RECALL ONE (1) (2)	TEXT EVOKED RECALL TWO (1) (2)	EXTERNAL RECALL ONE	EXTERNAL RECALL TWO
				T:	T:	T:	T:	T:	T:	T.	T.

Hierarchy of Propositions
Levels of Template Text Proposition
Categories of Recall

ii. NERVE CELLS DESCRIPTIVE INFORMATIONAL Text Worksheet



FEADING TIME ______________ SECS   STUDENT NO ____________   CATEGORY ____

NERVE CELLS- DESCRIPTIVE INFORMATIONAL TEXT
1 2 3 4 5 6

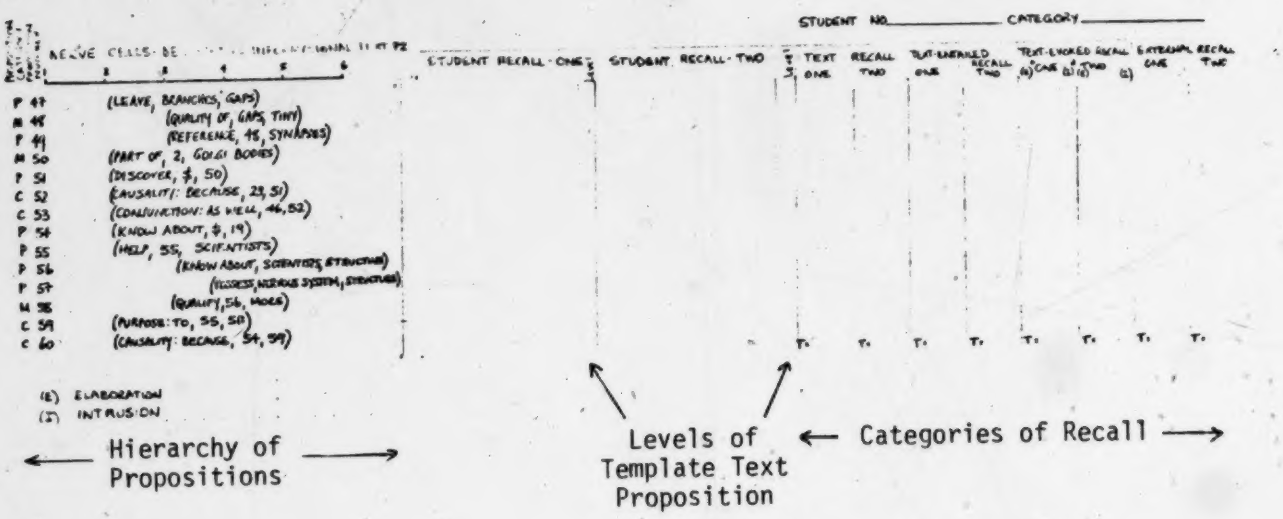
P 1 (EXIST, CELL)
M 2 (QUALIFY, CELL, NERVE)
M 3 (QUALITY OF, 2, TINY)
M 4 (QUALIFY, TINY, VERY)
P 5 (NEED, $, MICROSCOPE)
P 6 (STUDY, $, 2)
C 7 (PURPOSE: TO, 5, 6)
C 8 (CONJUNCTION: AND, 9, 9)
P 9 (EXIST, NEURON)
C 10 (LOC: IN, 9, 2)
P 11 (POSSESS, 9, BRANCHES)
M 12 (QUALITY OF, 11, TINY)
M 13 (NUMBER OF, 11, MANY)
P 14 (THINK, DOCTORS, 22)
M 15 (QUALIFY, DOCTORS, EARLY)
M 16 (QUALIFY, 2, ONE)
C 17 (LOC: IN, 12, 16)
P 18 (EXIST, CELLS)
M 19 (QUALIFY, 18, NERVE)
M 20 (QUALITY OF, 19, DIFFERENT)
C 21 (LOC: IN, 12, 20)
P 22 (JOIN, 17, 21)
P 23 (STAIN, $, I: SALTS, 19)
M 24 (QUALIFY, SALTS, SILVER)
P 25 (REFERENCE: 23, WAY)
P 26 (SEE, DOCTORS, 19)
C 27 (MANNER: IN, 26, DETAIL)
M 28 (QUALITY OF, DETAIL, CLEAR)
P 29 (HELP, 25, 27)
P 30 (POSSESS, DOCTORS, MINDS)
P 31 (CHANGE, DOCTORS, 30)
P 32 (HELP, 25, 31)
C 33 (CONJUNCTION: ALSO, 29, 32)
P 34 (EXIST, WAY)
P 35 (KNOW, NO ONE, 34)
P 36 (POSSESS, 2, APPEARANCE)
P 37 (CONCERN, $, 36)
C 38 (PURPOSE: TO, 35, 37)
C 39 (TIME: UNTIL, 23, 35)
P 40 (KNOW, DOCTORS, 45)
P 41 (JOIN, BRANCHES)
M 42 (QUALIFY, 41, REALLY)
C 43 (LOC: IN, BRANCHES, 20)
M 44 (NEGATE, 41)
M 45 (QUALIFY, 44, AT ALL)
M 46 (QUALIFY, 40, NOW)

STUDENT RECALL · ONE | LEVEL | STUDENT RECALL · TWO | LEVEL | TEXT ONE | RECALL TWO | TEXT-ENTAILED REC. ONE | TWO | TEXT EVOKED REC (I) ONE (II) (I· TWO II) | EXTERNAL ONE | RECALL TWO

← Hierarchy of Propositions →

Levels of Template Text Proposition

← Categories of Recall →



STUDENT NO.____________ CATEGORY____________

NERVE CELLS BE [illegible]

1 2 3 4 5 6

STUDENT RECALL · ONE

STUDENT RECALL · TWO

TEXT ONE

RECALL TWO

TEXT-ENTAILED ONE

RECALL TWO

TEXT-EVOKED RECALL (a) ONE (b) (c) TWO (c)

EXTERNAL RECALL ONE

TWO

P 47 (LEAVE, BRANCHES, GAPS)
M 48 (QUALITY OF, GAPS, TINY)
P 49 (REFERENCE, 48, SYNAPSES)
M 50 (PART OF, 2, GOLGI BODIES)
P 51 (DISCOVER, $, 50)
C 52 (CAUSALITY: BECAUSE, 23, 51)
C 53 (CONJUNCTION: AS WELL, 46, 52)
P 54 (KNOW ABOUT, $, 19)
P 55 (HELP, 55, SCIENTISTS)
P 56 (KNOW ABOUT, SCIENTISTS, STRUCTURE)
P 57 (TISSUES, NERVOUS SYSTEM, STRUCTURE)
M 58 (QUALITY, 56, MORE)
C 59 (PURPOSE: TO, 55, 58)
C 60 (CAUSALITY: BECAUSE, 54, 59)

T. T. T. T. T. T. T. T.

(E) ELABORATION
(I) INTRUSION

← Hierarchy of Propositions →

Levels of Template Text Proposition

← Categories of Recall →

iii. TELEPHONE STORY NARRATIVE Text Worksheet

READING TIME ______ SECS
STUDENT NO ______
CATEGORY ______

TELEPHONE - STORY NARRATIVE TEXT
1 2 3 4 5 6

P 1 (ISA, ALEXANDER GRAHAM BELL, PROFESSOR)
C 2 (LOC: AT, 1, BOSTON UNIVERSITY)
P 3 (EXPERIMENT, 1, I: ELECTRICITY)
P 4 (FIND, 1, WAY)
P 5 (CARRY, 1, I: ELECTRICITY, VOICE)
C 6. (PURPOSE: TO, 4, 5)
C 7 (TIME: IN, 6, 1876)
P 8 (MAKE, 1, I: SHEET, TRANSMITTER)
M 9 (QUALITY OF, SHEET, METAL)
M 10 (QUALITY OF, 9, THIN)
P 11 (EXIST, BOX)
P 12 (POSSESS, BOX, SAND)
M 13 (QUALITY OF, SAND, GRAINS)
C 14 (LOC: BEHIND, 12, METAL)
P 15 (RUN, ELECTRICITY)
C 16 (LOC: THROUGH, 15, 13)
P 17 (VIBRATE, METAL)
P 18 (EXIST, SOUNDS)
M 19. (QUALIFY, SOUNDS, VOICE)
C 20. (CAUSALITY: MAKE, 14, 17)
P 21 (WIGGLE, 13)
C 22 (CAUSALITY: MAKE, 20, 21)
P 23 (FLOW, ELECTRICITY, I: WIRE, G: RECEIVER)
P 24 (POSSESS, ELECTRICITY, AMOUNTS)
M 25. (QUALIFY, 24, DIFFERENT)
C 26. (CAUSALITY: THEN, 22, 23)
P 27. (REFERENCE: 25, COPIES)
P 28. (POSSESS, 19, COPIES)
M 29 (QUALIFY, COPIES, DIFFERENT)
P 30. (MAKE, 1, I: 10, RECEIVER)
C 31 (CONJUNCTION: ALSO, 8, 30)
P 32. (PULL, ELECTROMAGNET, 9)
C 33. (LOC: TOWARDS, 32, ITSELF)
C 34 (CAUSALITY: MAKE, 23, 33)
P 35. (VIBRATE, SHEET)
P 36. (HEAR, 1, 19)
C 37. (CONJUNCTION: AND, 35, 36)
C> 38. (CAUSALITY: BECAUSE, 34, 37)
P 39. (POSSESS, 1, WORDS)
M 40. (QUALITY OF, WORDS, TELEPHONE)
M 41. (QUALIFY, 40, FIRST)
P 42. (REFERENCE, 41, CRY)
M 43 (QUALITY OF, CRY, HELP)
P 44 (SPILL, 1, ACID)
C 45 (LOC: OVER, 44, CLOTHES)
P 46. (POSSESS, 1, CLOTHES)

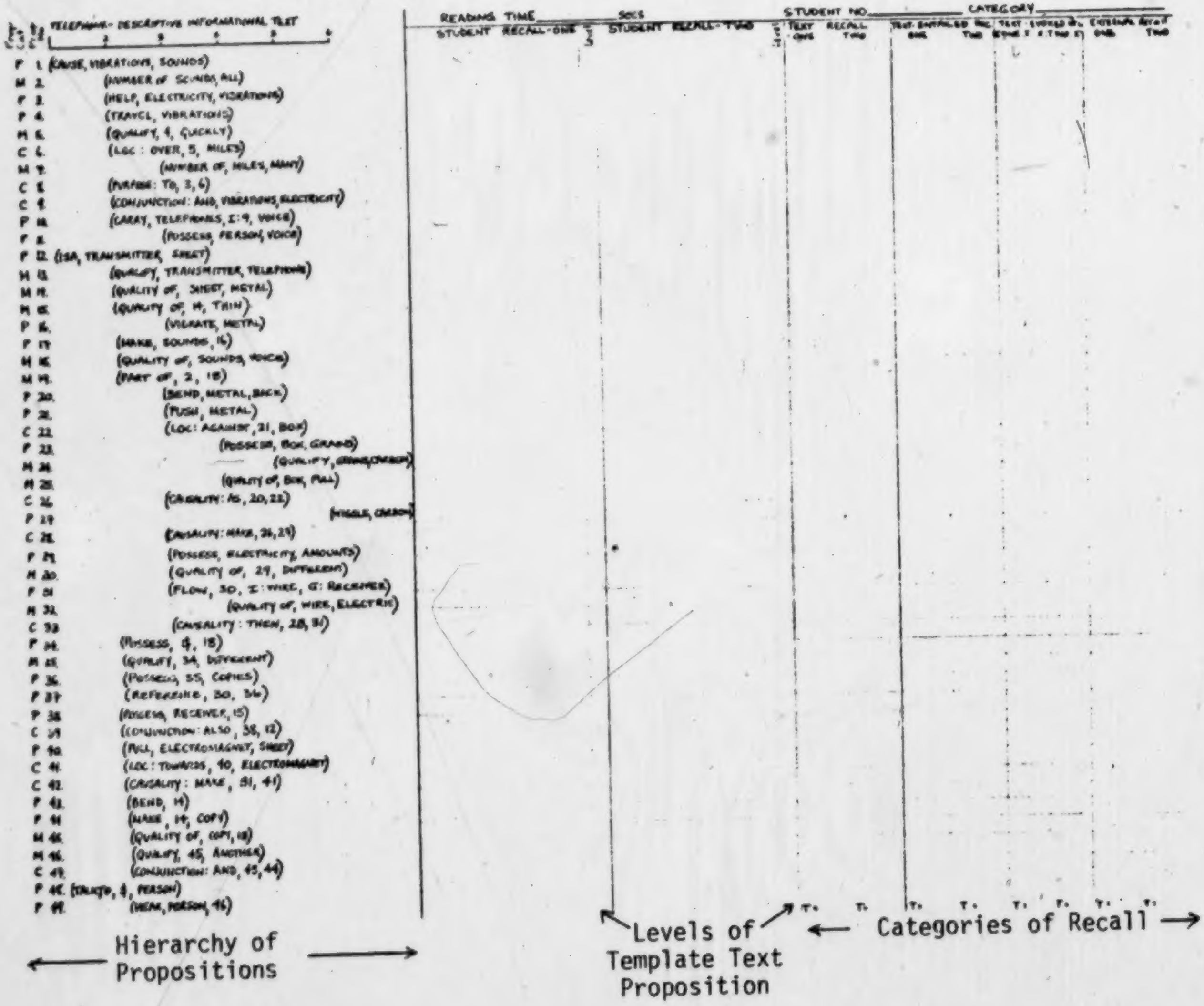
← Hierarchy of Propositions →

STUDENT RECALL ONE	LEVEL	STUDENT RECALL TWO	LEVEL	TEXT RECALL ONE	TEXT RECALL TWO	TEXT ENTAILED RECALL ONE	TEXT ENTAILED RECALL TWO	TEXT LINKED RECALL (a) ONE (b)	TEXT LINKED RECALL (a) (b) TWO (c)	EXTERNAL RECALL ONE	EXTERNAL RECALL TWO
				T.	T.	T.	T.	T.	T.	T.	T.

Levels of Template Text Proposition

← Categories of Recall →

iv. TELEPHONE DESCRIPTIVE INFORMATIONAL Text Worksheet



READING TIME __________ SECS STUDENT NO. __________ CATEGORY __________

TELEPHONE- DESCRIPTIVE INFORMATIONAL TEXT

P 1. (CAUSE, VIBRATIONS, SOUNDS)
M 2. (NUMBER OF, SOUNDS, ALL)
P 3. (HELP, ELECTRICITY, VIBRATIONS)
P 4. (TRAVEL, VIBRATIONS)
M 5. (QUALIFY, 4, QUICKLY)
C 6. (LOC: OVER, 5, MILES)
M 7. (NUMBER OF, MILES, MANY)
C 8. (PURPOSE: TO, 3, 6)
C 9. (CONJUNCTION: AND, VIBRATIONS, ELECTRICITY)
P 10. (CARRY, TELEPHONES, I:9, VOICE)
P 11. (POSSESS, PERSON, VOICE)
P 12. (ISA, TRANSMITTER, SHEET)
M 13. (QUALIFY, TRANSMITTER, TELEPHONE)
M 14. (QUALITY OF, SHEET, METAL)
M 15. (QUALITY OF, 14, THIN)
P 16. (VIBRATE, METAL)
P 17. (MAKE, SOUNDS, 16)
M 18. (QUALITY OF, SOUNDS, VOICE)
M 19. (PART OF, 2, 18)
P 20. (BEND, METAL, BACK)
P 21. (PUSH, METAL)
C 22. (LOC: AGAINST, 21, BOX)
P 23. (POSSESS, BOX, GRAINS)
M 24. (QUALIFY, [illegible])
M 25. (QUALITY OF, BOX, FULL)
C 26. (CAUSALITY: AS, 20, 22)
P 27. (WIGGLE, CARBON)
C 28. (CAUSALITY: MAKE, 26, 27)
P 29. (POSSESS, ELECTRICITY, AMOUNTS)
M 30. (QUALITY OF, 29, DIFFERENT)
P 31. (FLOW, 30, I: WIRE, G: RECEIVER)
M 32. (QUALITY OF, WIRE, ELECTRIC)
C 33. (CAUSALITY: THEN, 28, 31)
P 34. (POSSESS, $, 15)
M 35. (QUALIFY, 34, DIFFERENT)
P 36. (POSSESS, 35, COPIES)
P 37. (REFERENCE, 30, 36)
P 38. (POSSESS, RECEIVER, 15)
C 39. (CONJUNCTION: ALSO, 38, 12)
P 40. (PULL, ELECTROMAGNET, SHEET)
C 41. (LOC: TOWARDS, 40, ELECTROMAGNET)
C 42. (CAUSALITY: MAKE, 31, 41)
P 43. (BEND, 14)
P 44. (MAKE, 14, COPY)
M 45. (QUALITY OF, COPY, 18)
M 46. (QUALIFY, 45, ANOTHER)
C 47. (CONJUNCTION: AND, 43, 44)
P 48. (TALKTO, $, PERSON)
P 49. (HEAR, PERSON, 46)

1
2
3
4
5
6
STUDENT RECALL-ONE
STUDENT RECALL-TWO
TEXT ONE
RECALL TWO
TEXT-ENTAILED INC. ONE
TWO
TEXT-EVOKED INC. ONE
TWO
EXTERNAL ERROR ONE
TWO
T1 T2 T1 T2 T1 T2 T1 T2
Hierarchy of Propositions
Levels of Template Text Proposition
Categories of Recall

v. EXAMPLE OF SCORE SHEET FOR RECALL PROPORTIONS, TYPES OF PROPOSITIONS, LEVELS IN TEXT HIERARCHY OF PROPOSITIONS AND POSITION OF RECALL PROPOSITIONS IN TEMPLATE TEXT

Propositional Recall TEXT AND ENTAILED CATEGORIES

Subject _________ __________ Stanford Vocab ______ Comp ______

TELEPHONE STORY NARRATIVE

Recall Proportions	__/46	____	__/46	____
Predicate Proportions	__/23	____	__/23	____
Modifier Propositions	__/9	____	__/9	____
Connective Propositions	__/14	____	__/14	____
Text Level				
High	__/26	____	__/26	____
Medium	__/20	____	__/20	____
Low	__/0	____	__/0	____

Text Parts

Theme	__/7	____	__/7	____
Body	__/31	____	__/21	____
Resolution	__/8	____	__/8	____

NERVE CELLS DESCRIPTIVE INFORMATIONAL

Recall Proportions	__/60	____	__/60	____
Predicate Proportions	__/28	____	__/28	____
Modifier Propositions	__/18	____	__/18	____
Connective Propositions	__/14	____	__/14	____
Text Level				
High	__/48	____	__/48	____
Medium	__/12	____	__/12	____
Low	__/0	____	__/0	____

Text Parts

Topic Identification	__/13	____	__/13	____
Topic Expansion	__/40	____	__/40	____
Conclusion Statements	__/7	____	__/7	____